SEPTEMBER 1942—FORTY-NINTH YEAR

# MACHINERY

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With a Heald branch office located in all primary manufacturing areas and service dealers closely affiliated with the Heald organization in other industrial centers, manufacturers having any precision finishing problems can obtain prompt and often definite data right at home in their own office by calling a local Heald representative.

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**THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A.**

**MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES**

DESIGN, CONSTRUCTION, OPERATION OF METAL-WORKING AND ALLIED EQUIPMENT

# MACHINERY

SEPTEMBER, 1942

The cartridge links that are assembled with cartridges to form flexible metallic feeder belts for machine guns and automatic rifles may appear to be a minor part in the Armament Program; but their manufacture requires no less ingenuity in the design of the tools and equipment, and precision in performing the manufacturing operations, than many larger munitions products. The leading article in October MACHINERY will deal with the manufacture of cartridge links for machine guns and automatic rifles. Other unusual articles will deal with the rifling of machine-gun barrels by broaching, and the building of boring mills for tank production in an automobile-body die shop.

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MACHINERY

Volume 49 NEW YORK, SEPTEMBER, 1942 Number 1

# Hall-Scott Marine Engines Aid Invasion and Defense

By CHARLES O. HERB

Approved for Publication by the Navy Department

**Submarine Chasers, Aircraft Rescue Boats and Other Small Craft in Combat Service around the World are being Driven by Engines Built in a Prominent Pacific Coast Plant which Produces Engines for Pleasure Boats in Peacetime**

THE smaller boats of the sea are playing a heroic part in winning the war. Torpedo patrol boats have sunk a considerable number of large enemy vessels and are proving indispensable in patrolling coast lines. The larger British *Fairmile* is being used all over the Eastern Hemisphere as a submarine chaser, patrol boat, and convoy protecting vessel. Ships of this type proved invaluable in evacuating troops

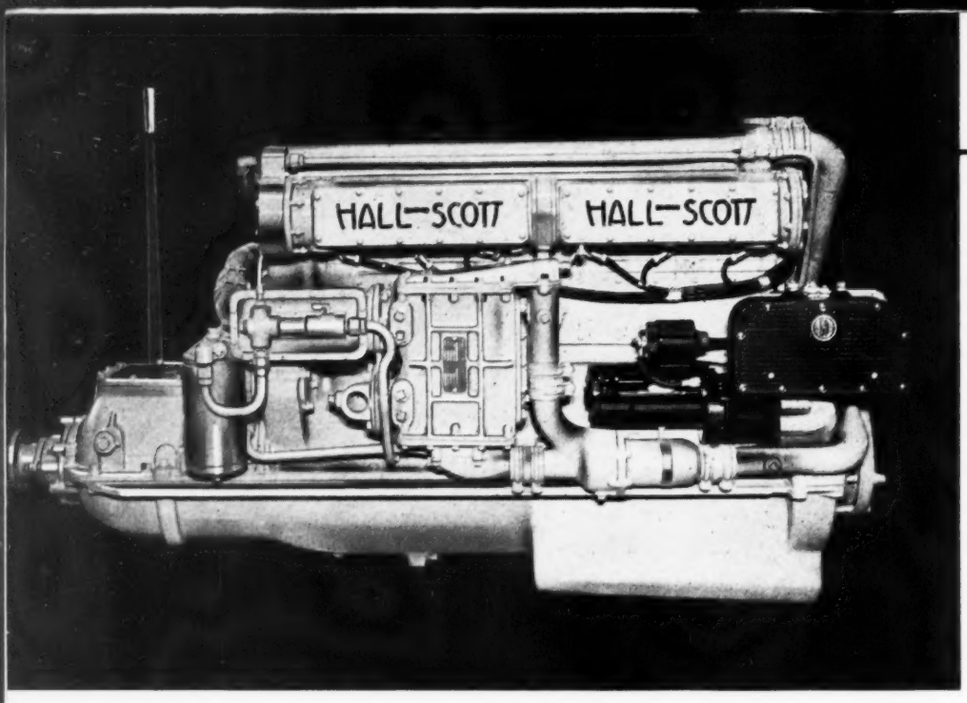


*Fig. 1. "Invader" Gasoline Engine which is being Widely Used as the Motive Power for Landing Boats, Rescue Boats, Target Boats, and Similar Small Craft by the Navies of the United Nations*

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from Dunkerque, Crete, and Singapore. When the British Commandos make their raids on enemy-occupied soil, they are to a large extent transported on the speedy *Fairmile*. Other gasoline-powered boats are employed for rescuing aircraft pilots who have been downed at sea and for towing practice targets.

Marine engines for boats of all these types are being produced in large numbers by the Hall-Scott Motor Car Co., Berkeley, Calif., Division of the American Car and Foundry Motors Company. Engines of both V and straight in-line styles are built by this concern in ratings up to 1000 H.P. The in-line "Invader," which was formerly produced principally for pleasure craft, police patrol boats, etc., is manufactured in direct-driven and high-speed reduction-gear types that develop from 180 H.P. at 1500 R.P.M. up to 275 H.P. at 2100 R.P.M. One of these "Invader" engines is illustrated in Fig. 1.

The V-12 cylinder "Defender" is produced in direct-driven and reduction-gear types and with or without a supercharger. When equipped with a supercharger, this engine will develop approximately 1000 H.P. at 2100 R.P.M. Two standard "Defenders" power the British *Fairmile*, while three supercharged engines of this design are used on several United States Navy torpedo patrol boats. Fig. 3 shows a standard engine of this type.

Up to the present, the concern has built engines totaling more than 1,250,000 H.P. of the "Invader" and "Defender" types for the war effort. They have been produced by manufacturing methods that were developed over a long period of years and that are comparable with the best practice anywhere. Typical operations are described in this article.

In the raw materials storage department, use is made of the Peerless high-duty metal-cutting power saw illustrated in Fig. 5, which is equipped with a bar feed. The operation of this machine is completely automatic, including feeding of the stock forward at the beginning of each

*Fig. 2. One of the British "Fairmiles" which have Rendered Distinguished Service both in Offense and Defense*

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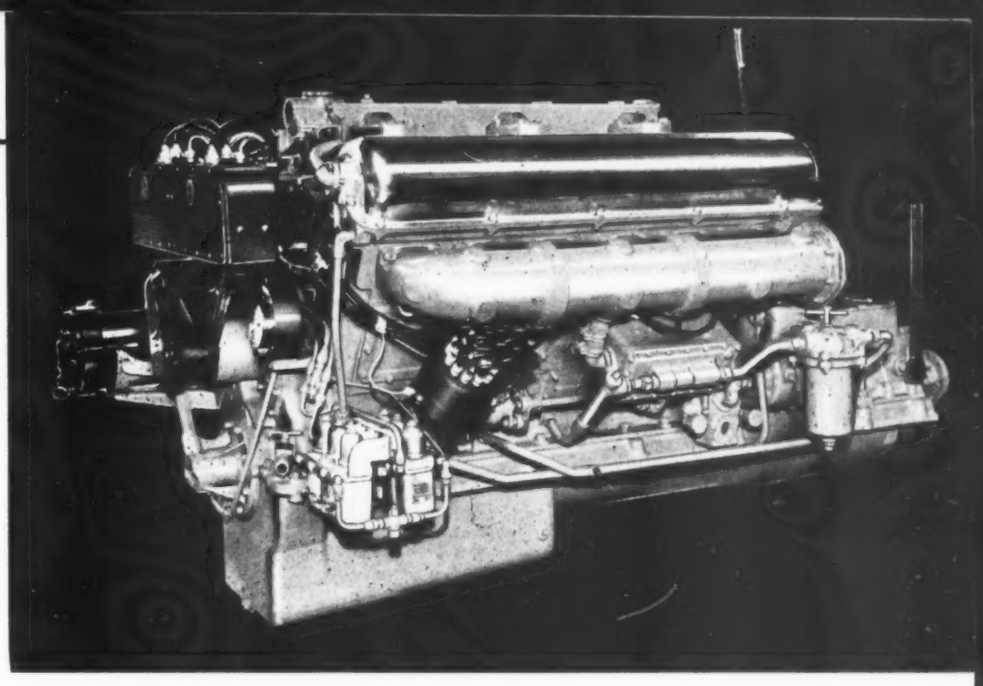

*Fig. 3. Standard "Defender" Engine, Two of which Power the British "Fairmile" Patrol Boats. Three of These Engines Equipped with Superchargers Drive United States Torpedo Patrol Boats*

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cycle, gaging the position of the front ends of the stock, so as to obtain cut-off pieces of the desired length, clamping of the vise, feeding the blade through the work, raising the blade upon the completion of the cut, and unclamping of the vise. In addition, the machine is automatically stopped in the event that a blade becomes broken during the course of a cut. All operations are controlled by individual hydraulic cylinders, which are energized through a master valve.

The micrometer-set length gage meets the stock as it is fed forward and thus fixes the length that extends in front of the saw. When the stock has been clamped in this position, the length gage swings upward, clear of the work. This gage can be set for cutting stock to any length from 1/8 inch to 24 inches. The maximum capacity of the machine is 9 by 9 inches. At the time that the photograph was taken, the machine was engaged in cutting four bars, 3 3/4 inches in diameter. The vise on the carriage is clamped to the rear end of the stock.

A gang type boring machine designed specifically for boring a considerable range of cylinder blocks is shown in Fig. 6. Two of these machines were built in the Hall-Scott tool-room. The boring spindles are carried at their upper ends in bearing boxes that are adjustable along a cross-rail, so as to accommodate any required center-to-center distances between cylinder bores. Power is delivered to the spindles at their upper ends from an overhead motor drive through universal joints and telescopic shafts.

In operation, the cross-rail with the boring tool is quickly traversed downward until the cutters approach the work, and then fed at a slower rate for the actual cutting, both the quick traverse and the feed being obtained by hydraulic means. The boring-bars are piloted both above and below the work. Below the work they are guided by bushings in the fixture, which are provided with four pins, as seen in Fig. 7, that project about 1/8 inch from the inside of the bushings. These bushing pins are engaged by

*Fig. 4. An Aircraft Rescue Vessel, which is Driven by a Pair of Direct-drive "Defender" Engines*

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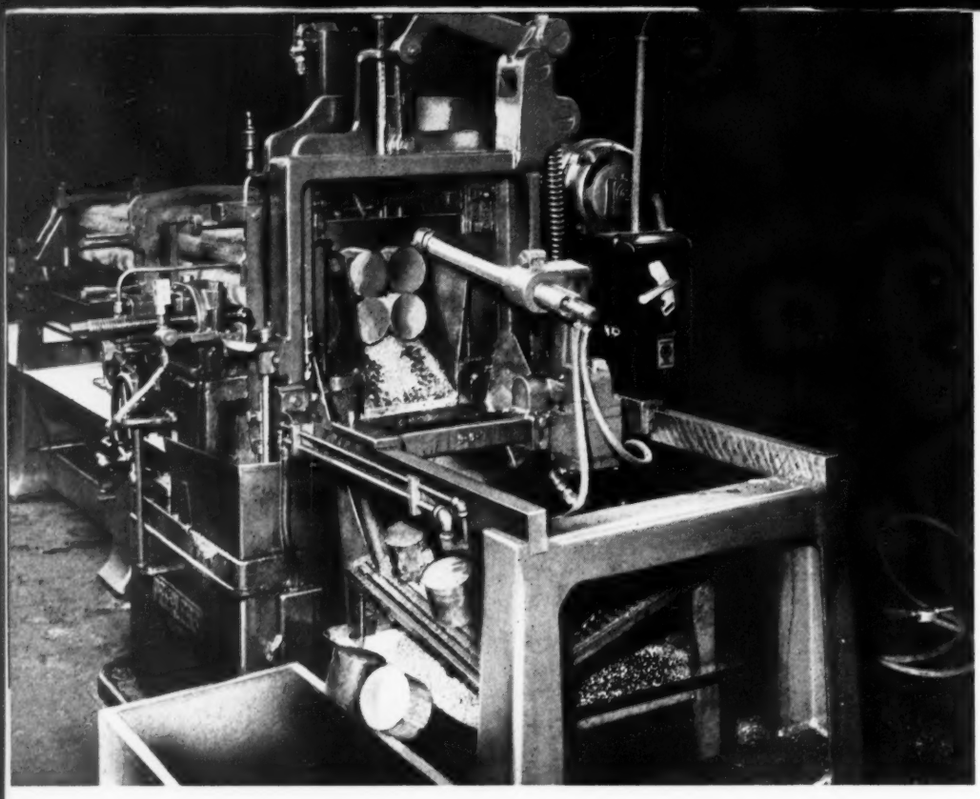

*Fig. 5. High-duty Metal-cutting Power Saw that Automatically Cuts off Successive Pieces of Stock to Predetermined Lengths*

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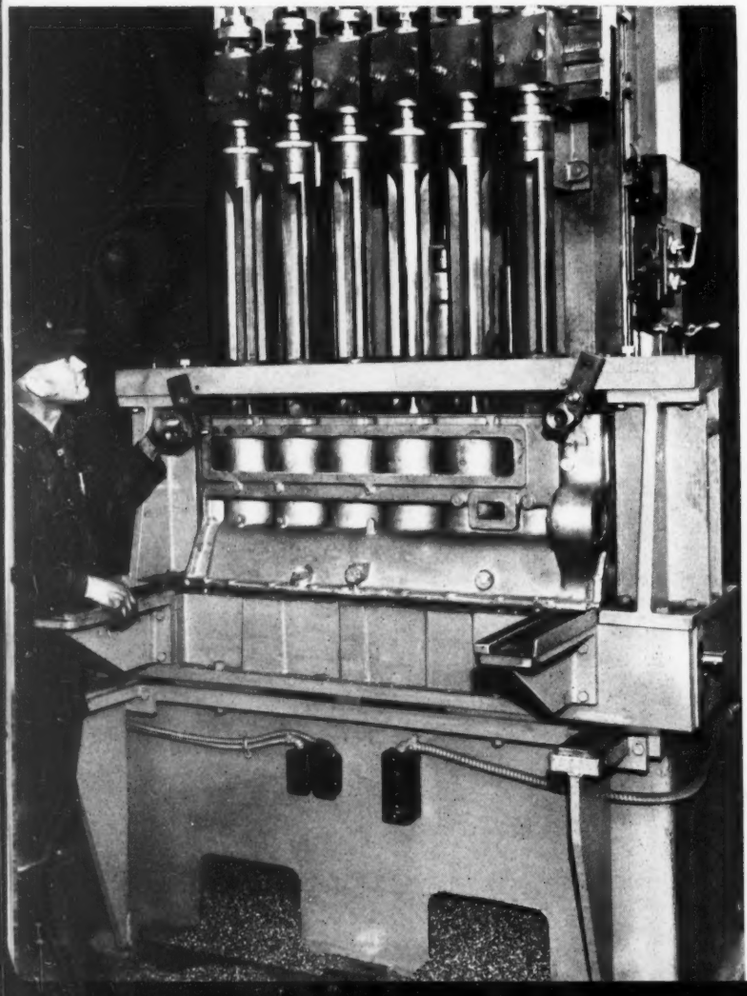
*Fig. 6. Special Six-spindle Boring Machine Designed to Accommodate Cylinder Blocks of Various Cylinder-bore Center-to-center Distances*



splines or flutes which extend practically the full length of the boring-bars, so that the bushings are revolved during boring, a feature that facilitates the clearing of chips.

Above the work the boring-bars are guided by loose bushings, slidably mounted on the bars, which engage pockets in a plate that extends across the top of the fixture, as seen in Fig. 6. The use of bushings both above and below the work insures correct vertical positioning and parallelism of all boring-bars. When the boring-bars are withdrawn upward, the top bushings are lifted from the bushing plate by the lower ends of the boring-bars. Rough and finish cuts are taken on machines of this type.

When the cylinder blocks reach this operation, they have been milled on the top and bottom and locating holes have been drilled and reamed along one of the flanges on the crankcase end. Each cylinder block is seated on the hardened and ground pads on the fixture, which are clearly shown in Fig. 7, and located accurately with respect to the boring-bars by entering two dowel-pins at the front of the fixture into the previously reamed holes in the cylinder block flange. These dowel-pins are raised and lowered by operating levers at the ends of the fixture.

Two cutters are provided on each side of the boring-bars. They remove 1/8 inch of stock on a side from the nickel-iron castings in rough-boring, and 0.090 inch in finishing. The nominal diameter of the cylinder bores on the block shown is 5 1/2 inches, and this diameter must be held to close limits in finish-boring.

*Fig. 7. The Boring-bars on the Machine Shown in Fig. 6 are Guided below the Work by Bushings which Revolve in the Work-fixture*

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After being finish-bored, the cylinder blocks are reamed closely to size, and then they are transferred to a Barnes single-spindle honing machine, such as shown in Fig. 9, where the bores are honed to size within plus or minus 0.00075 inch. A mixture of kerosene and a thick cutting oil is used as a lubricant in this operation. At the time that the photograph was taken, the machine was being used for honing a cylinder block for an industrial engine, in which the diameter of the cylinder bores was 5.5 inches. They were honed for a length of 7 inches.

The method of grinding the valve-seats in the cylinder heads is shown in Fig. 8. Application is made of a Hall 1/2-H.P. portable electric grinder equipped with an abrasive wheel that is trued to the desired radius of the valve-seats. The grinder spindle has an internal bearing surface that mates with pilot-pins previously inserted in the valve-stem holes, as illustrated. These pilot-pins are equipped with a split bearing at the lower end, which is expanded to a tight fit in the valve-stem hole by turning the bolt head at the top end of the pin. The rotation of the bolt causes a taper plug to be pulled upward into the split bearing. When the bolt is revolved in the opposite direction, the split bearing is, of course, released.

The grinding wheel is revolved in a slightly eccentric path, so that it "drifts" around the valve-seats. At the end of the operation, each valve-seat must be concentric with its valve-stem hole within 0.0005 inch, as determined by means of a dial indicator.

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*Fig. 8. Ingenious Method of Grinding the Valve-seats in Cylinder Heads Concentric with the Valve-stem Holes to a High Degree of Accuracy*

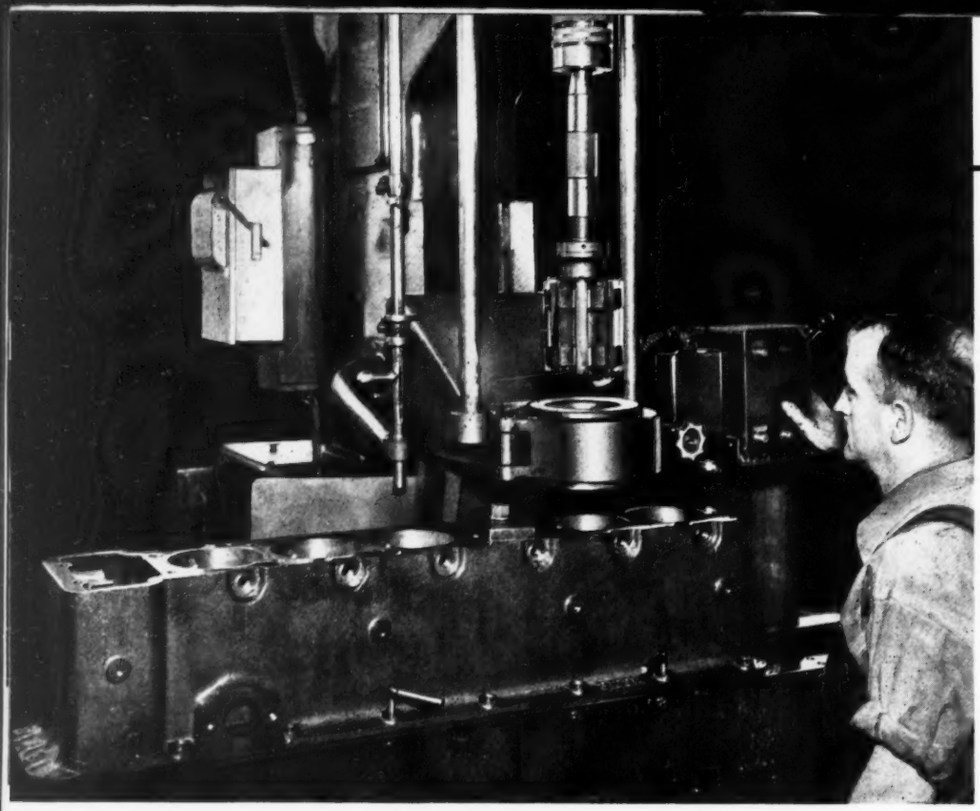

*Fig. 9. All Cylinder Bores are Honed to a High Finish by Single-spindle, Hydraulically Operated Machines of the Type Here Shown*

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Interchangeability of engine parts is insured by the extensive use of jigs and fixtures. In Fig. 10, for example, is seen an angular fixture designed to permit flat milling of two angular surfaces on upper crankcases for "Defender" engines. The operation is performed on a planer type milling machine. When one angular surface has been finished on a crankcase, the casting is reversed for finishing the other angular surface.

The cylinder hold-down holes in the upper crankcases are drilled, reamed, tapped, and counterbored on the Carlton radial drilling machine illustrated in Fig. 11. Use is made of a drill bushing plate to insure obtaining the specified center distances within a cumulative error of not more than 0.004 inch. Fourteen holes of 43/64 inch diameter are drilled in each angular surface for a depth of 2 1/2 inches. The holes are then reamed to between 0.756 and 0.757 inch, and tapped with 16 threads per inch for a depth of 2 inches.

High-production methods have been applied in the connecting-rod lines particularly. In Fig. 12 is shown one of several operations performed in machining the fork end of connecting-rods. This operation consists of straddle-milling the inside and outside faces of the fork on a Sundstrand Rigidmil. The fork end of the rod is securely held in heavy blocks on the fixture, while the piston-pin end is supported on an adjustable cen-

*Fig. 10. Finishing the Angular Surfaces on Upper Crankcases by the Use of a Special Fixture on a Planer Type Milling Machine*

★

*Fig. 11. Drilling the Cylinder Hold-down Bolt Holes in an Upper Crankcase to Specified Center Distances by Using a Jig Bushing Plate*

ter of a tailstock, so as to insure parallel positioning of the rod with the top of the table.

A special machine built in the Hall-Scott toolroom and equipped with a Heald Red Head grinding head is employed, as shown in Fig. 13, for grinding the crankpin bearing of the connecting-rods. This operation is performed after the bearing caps have been assembled to the rod.

A large dial indicator on the cross-slide of this machine, which is graduated to 0.0001 inch, shows the amount of stock that has been ground from a rod. At the beginning of an operation, the crankpin bearing to be ground is placed over the dial gage seen in a wooden box at the right-hand end of the machine, so as to determine the amount of stock to be ground from the bearing in order to obtain the specified size. This gage is also graduated to 0.0001 inch. Then the grinding wheel is trued for the roughing cut, and with the wheel in contact with the bearing to be ground, the dial indicator on the cross-slide is adjusted to read zero while its spindle is in contact with the rod, which is held stationary.

When the dial indicator shows that nearly the required amount of stock has been ground from the crankpin bearing, the grinding wheel is trued again for the finishing cut. The finish-ground bearing must be finished to 3.689 inches diameter plus 0.0002 inch, minus nothing. The bearings in both forks are ground in one set-up.

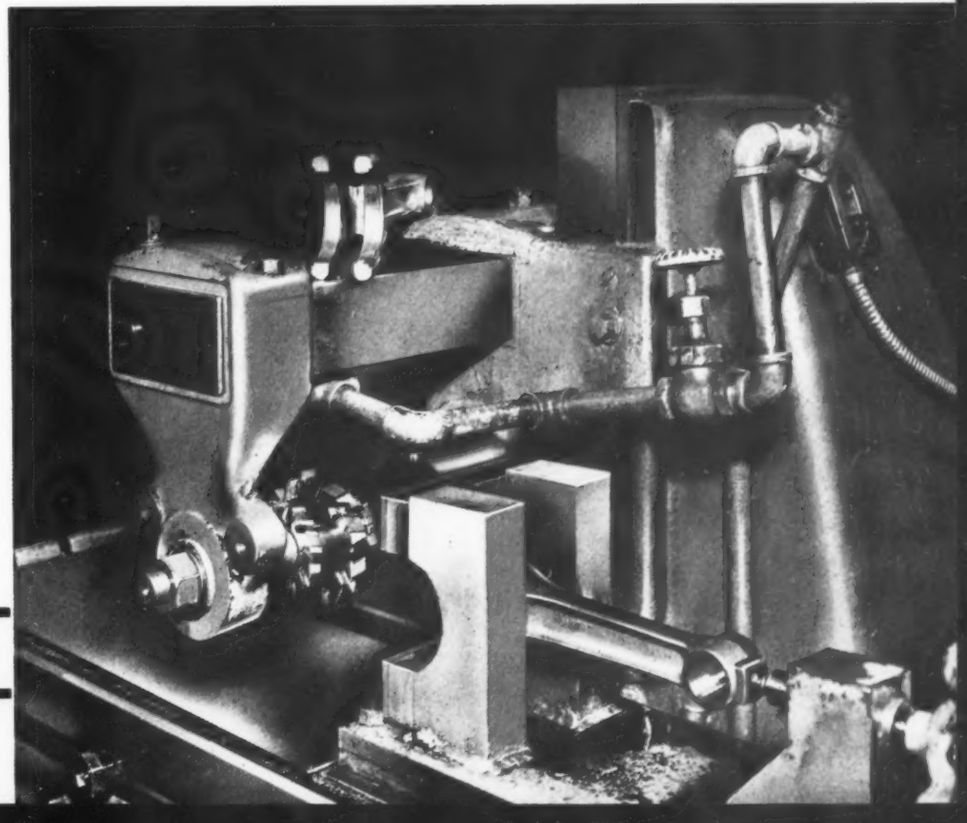

*Fig. 12. Straddle-milling Operation in which the Fork End of Connecting-rods is Milled on both Inside and Outside Faces*

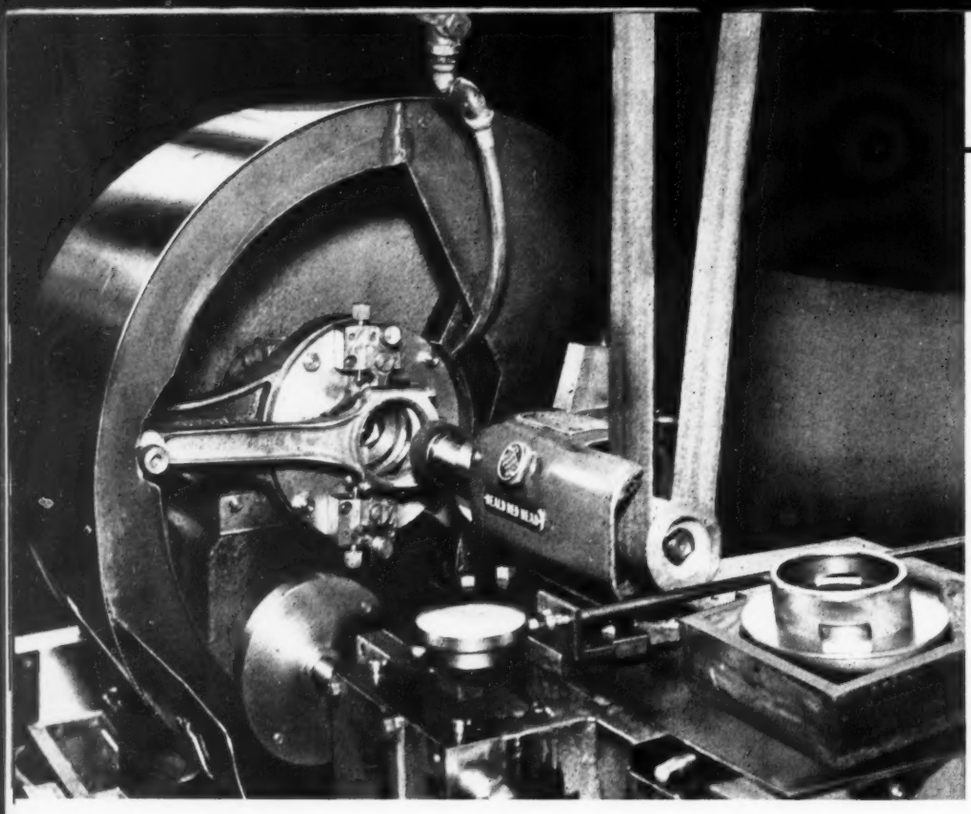

*Fig. 13. Grinding the Crankpin Bearings of a Connecting-rod in a Machine Equipped with a Dial Gage that Indicates the Progress of the Operation*

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The outside faces of the connecting-rod forks and their assembled caps are later ground to a true right angle in relation to the crankpin bearing on a Pratt & Whitney surface grinding machine set up as shown in Fig. 14. One of the crankpin bearing faces is seated over a plug on the fixture and the sides of the forks and bearing caps are brought into contact with parallel blocks on the fixture. The bottom fork is clamped on a hardened and ground block, as is also the wrist-pin end of the connecting-rod. Two hinged bars at the right-hand end of the fixture are adjusted against the under side of the top bearing cap to prevent springing of the fork during the grinding operation.

Accurate set-up of the work is obtained in this operation through the use of a dial gage mounted on a bar that is long enough to span the work and rest on hardened and ground surfaces of the fixture, which are parallel with the top of the magnetic chuck. The spindle of the gage can be conveniently moved across the surface to be ground. The gage is employed in checking the parallelism of the connecting-rod fork and cap while adjusting the supporting finger under the top cap and also before removing the work from the fixture at the end of the operation.

Between the passes of the grinding wheel, the gage is also used to determine how much more stock must be removed in order to bring this

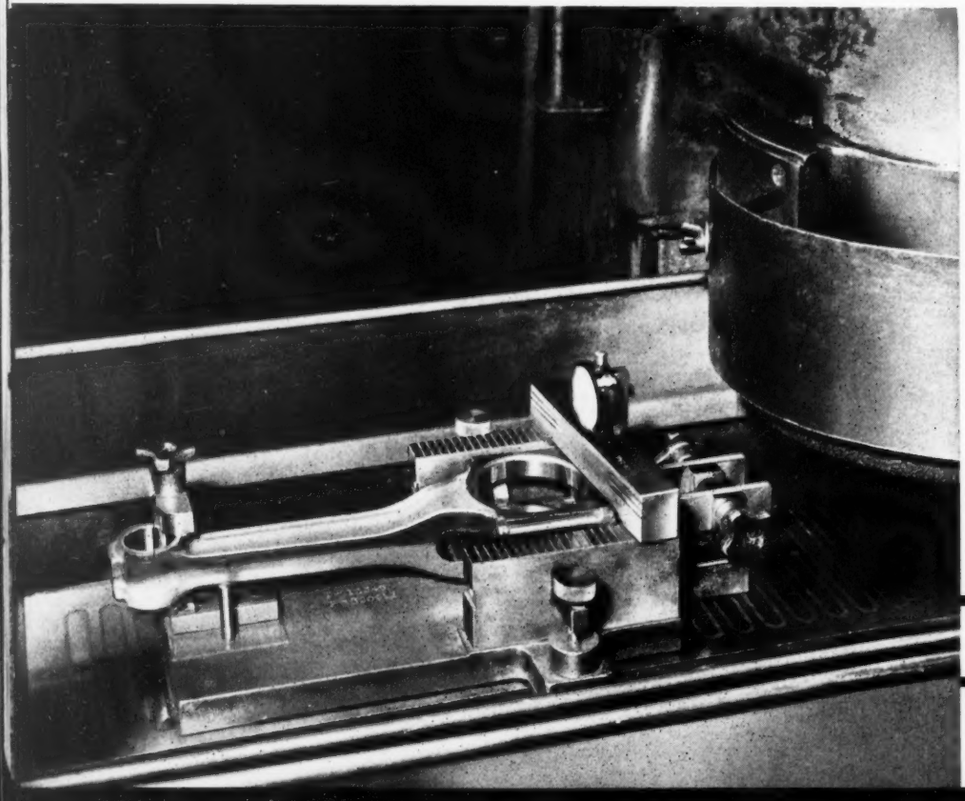

*Fig. 14. Work-fixture and Gage Designed to Enable Unusual Accuracy to be Attained in Grinding the Outer Faces on Crankpin End of Connecting-rods*

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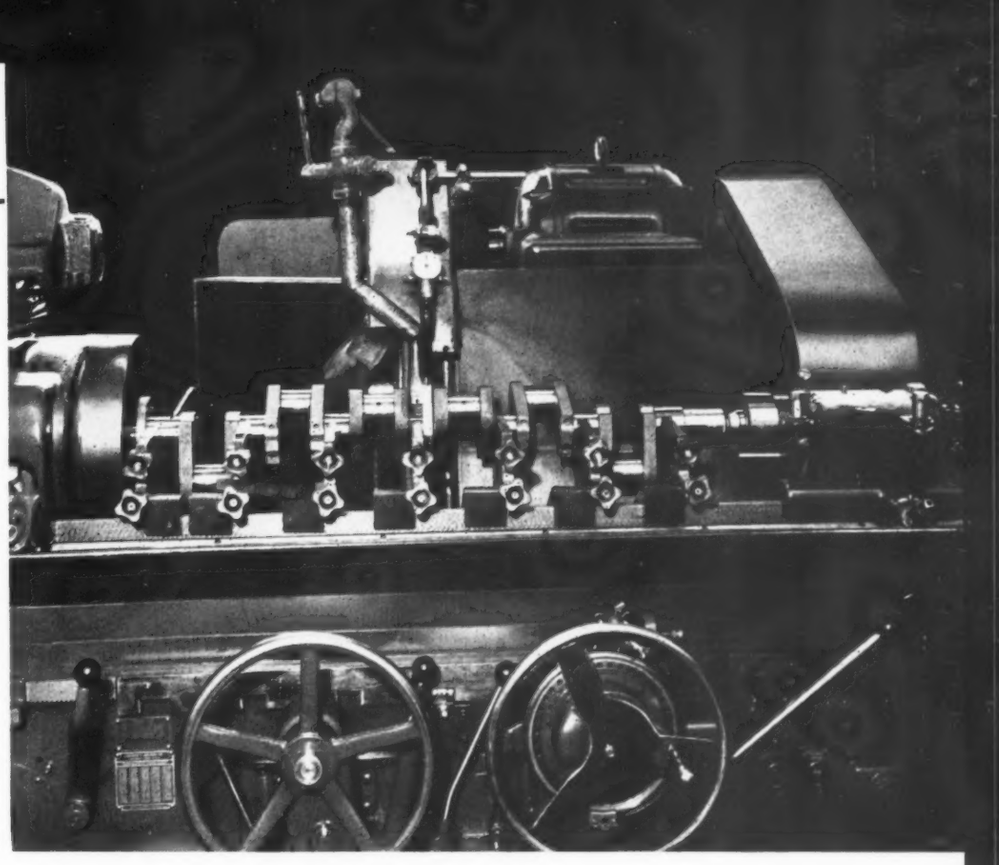

*Fig. 15. The Main Bearings of Crankshafts are Ground by Methods Similar to Those Developed in the High-production Shops of the Automotive Industry*

surface of the connecting-rod to the specified distance from the center line of the rod within 0.0001 inch.

This close accuracy necessitates provision for seating the wrist-pin end on different surfaces of its locating block in grinding the two sides of the crankpin end. In other words, the locating block is of a two-stepped design to suit the difference in the distance from the center line of the connecting-rod to each outside fork surface when it is ground and the distance when the same surface was milled. Approximately 0.003 inch of stock is ground from the sides of the rods and somewhat more from the caps. This operation is one of the "fussiest" in the shop.

The crankpin bearings of the connecting-rods are next counterbored from the outside faces, after which the inside faces of the fork end and the caps are ground on a special surface grinding machine, which is illustrated in Fig. 17. Use is made of a fixture equipped with a Brown & Sharpe permanent-magnet chuck on which the crankpin end is supported as shown. The opposite end of the connecting-rod is seated over a plug at the front end of the fixture in a manner that insures parallelism of the fork faces.

Grinding is performed by an abrasive disk which is vulcanized on a circular steel plate. The abrasive disk is oscillated while it rotates, and the operator feeds it downward by means of the

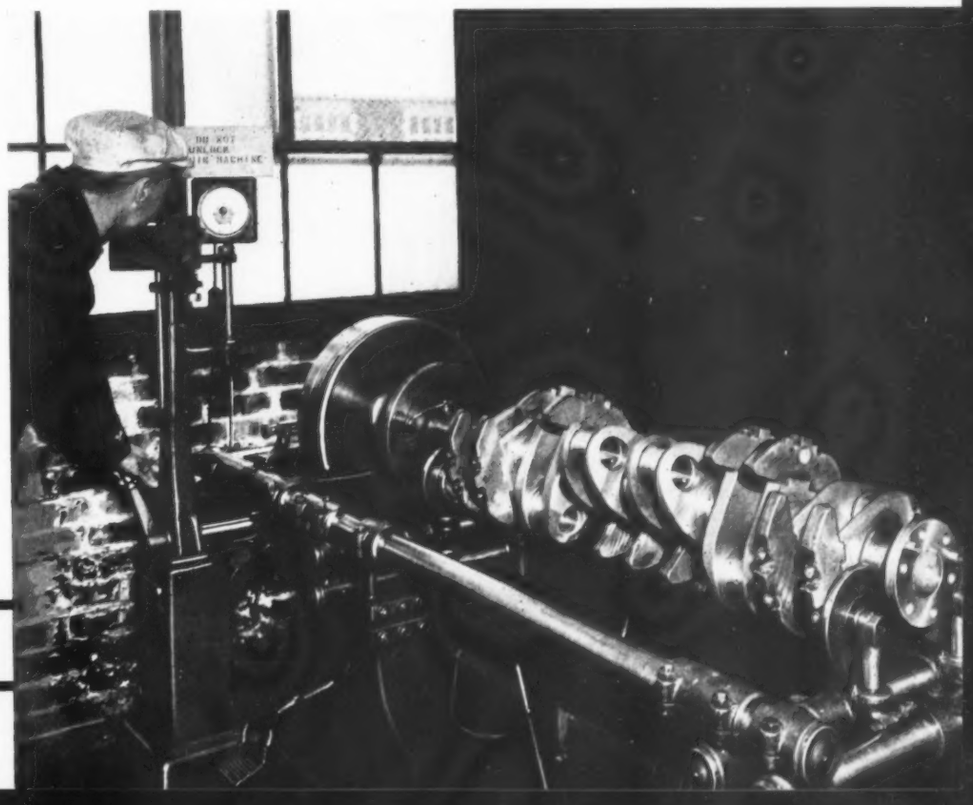

*Fig. 16. All Crankshafts Must be within Close Dynamic Balance. This Illustration Shows a Counterweighted "Defender" Crankshaft being Checked for Balance*

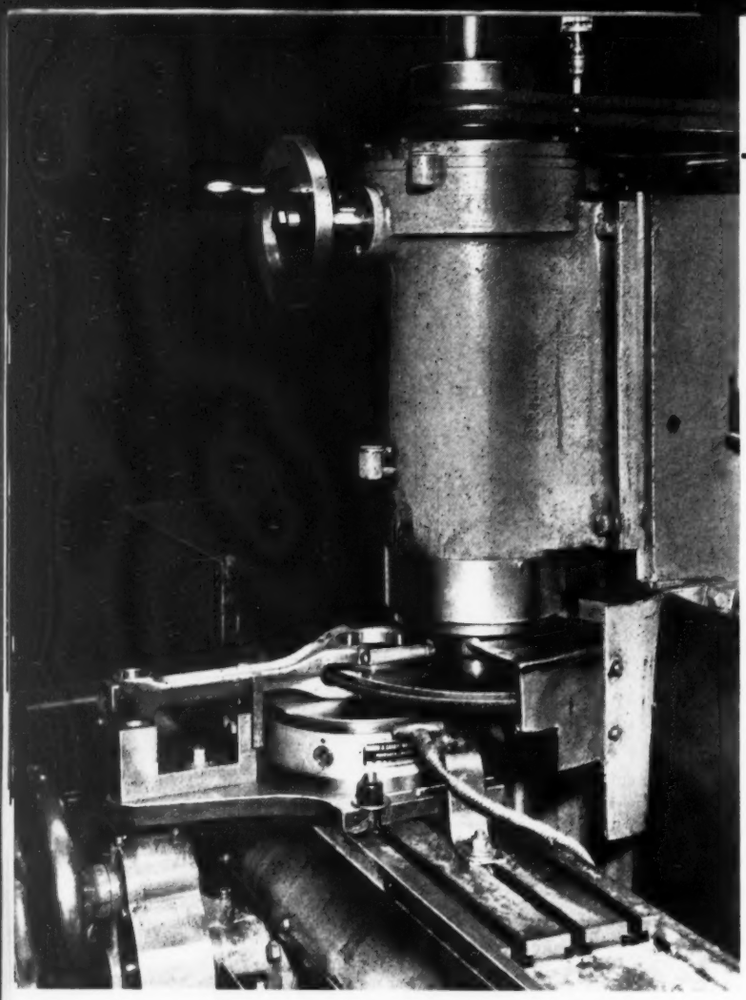

*Fig. 17. Grinding the Inside Faces on the Fork End of Connecting-rods, with the Work Held on a Permanent-magnet Chuck*

handwheel near the top of the grinding head. The distance from the center line of the fork to each inside surface must be maintained within 0.0005 inch, as the tolerance on the complete width of the opening is only 0.001 inch. The feed-wheel is graduated to 0.0001 inch to facilitate attainment of the required accuracy.

Crankshaft grinding is performed on standard types of machine tools, and regular automotive practice is followed. Fig. 15 shows a Cincinnati grinding machine being used for finishing the main bearings on the crankshaft for an "Invader" engine and also for finish-grinding a gear fit. All of these surfaces must be finished to specified diameters within plus 0.00025 inch, minus nothing, and the end bearings must be straight in line with each other within a maximum error of only 0.001 inch. The progress in grinding the individual bearings is indicated by a Pratt grinding gage, mounted on the wheel guard.

Upon the completion of all machining operations on the crankshafts, they go to the Gisholt precision balancing machine shown in Fig. 16. Corrections for dynamic balance found necessary are made by drilling, and the crankshafts are checked until they are dynamically balanced at both ends within 1 1/4 ounce-inches. Actually, the amount of unbalance is held to a much closer tolerance.

Pistons are ground to the required diameters on the Cincinnati grinding machine illustrated in Fig. 18, which is provided with an Ohio Unit attachment that rocks the piston back and forth a slight amount during the grinding of the skirt,

*Fig. 18. The Use of a Cam-operated Oscillating Attachment Enables the Skirts of Pistons to be Ground to an Oval Shape*

and thus enables the skirt to be ground to an oval shape rather than to a true circle. The amount of oscillation can be varied by means of a cam mounted on the regular headstock spindle of the machine, which revolves in contact with a roller on the rocking arm of the oscillating device. The piston is supported on an arbor on this device and also on a tailstock center that oscillates with the work. The major skirt diameter is from 5.488 to 5.489 inches, and the minor diameter from 5.474 to 5.475 inches.

In grinding the ring lands, the cam motion is disengaged as the lands are ground to a true circle. The tolerance on the lands is also 0.001 inch.

Bullard vertical turret lathes are used for a variety of boring, turning, and facing operations. In Fig. 19 a machine of this type is shown being used for finishing supercharger lower-drive gear housings. When this aluminum-alloy casting reaches the vertical turret lathe, it is first faced on the bottom side, as seen on the piece that stands at the front of the machine, and a narrow shoulder is turned around almost a complete circle at the inside of the faced surface. The shoulder is 3/16 inch high. It is finished to a diameter of 16.375 inches within a tolerance of 0.005 inch.

The casting is then reversed on the machine, as shown, for boring a hole at the top to a diameter of from 7.249 to 7.251 inches. A smaller hole that extends almost to the bottom of the work is also bored in this set-up to from 4.4345 to 4.4360 inches. This hole is bored to a shoulder, and the specified depth is 6.800 inches within

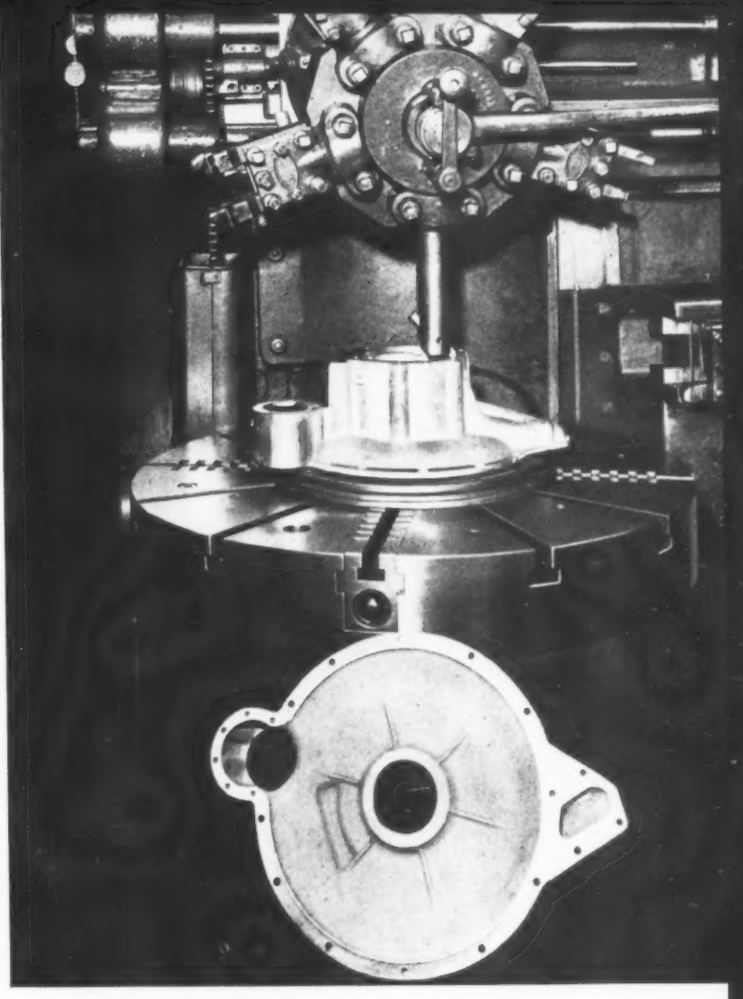

*Fig. 19. The Lower-drive Gear Housing for Superchargers is Finished Top and Bottom on a Vertical Turret Lathe*

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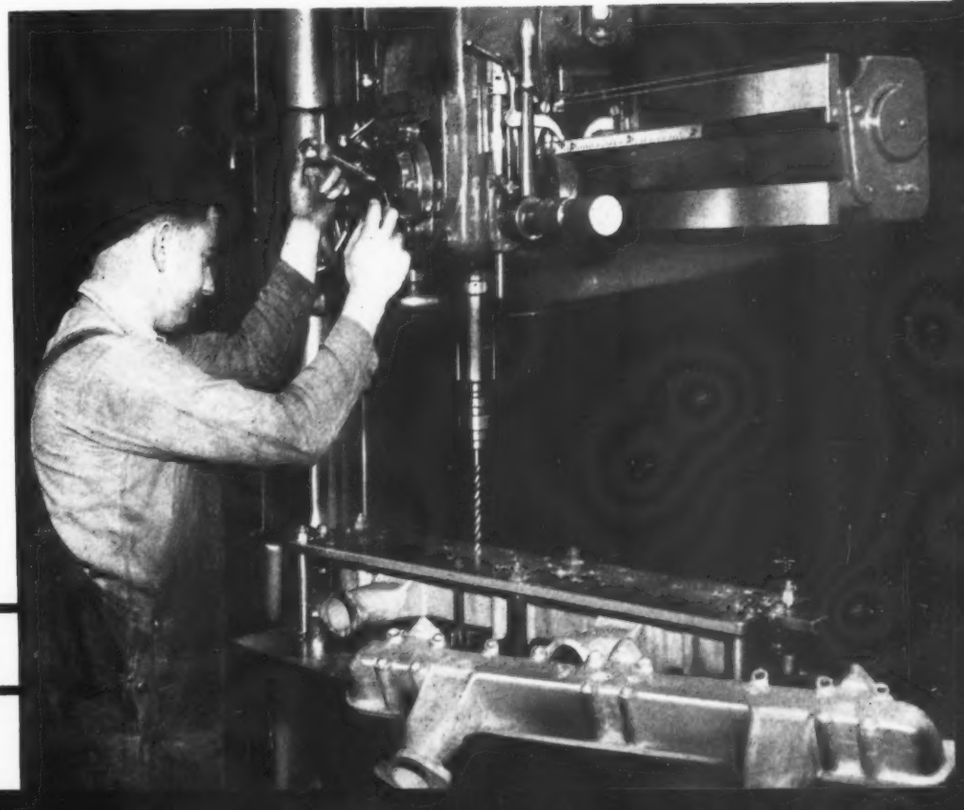

*Fig. 20. Sixteen Holes are Drilled Closely to Specified Center Distances on This Radial Drill Equipped with a Simple Box Jig*

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*Fig. 21. Grinding over One Hundred Oil-pump Driving Gears at One Time to the Prescribed Width within a Close Tolerance*

plus 0.010 inch, minus nothing. Two surfaces are faced in this operation in addition to the boring. The part is clamped from the inside.

Sixteen holes 9/16 inch in diameter are drilled closely to specified center distances in the joint face of manifolds by the Cincinnati Bickford radial drilling machine shown in Fig. 20. These holes are drilled to a depth of 4 inches. In addition, two small holes are drilled through the flange of the manifold. For this operation, use is made of a box jig in which the manifolds can be quickly loaded. Many tapping operations are also performed on this machine because of the ease with which the spindle can be reversed for withdrawing the tap from finished holes. The reversal is effected by merely turning a knurled sleeve on the right-hand side of the drill head.

The Blanchard surface grinding machine shown in Fig. 21 is used for a variety of work. At the time that the photograph was taken, the machine was engaged in grinding 116 oil-pump driving gears in one set-up. The gears had an



*Fig. 22. General View of Inspection Department to which Engine Parts are Routed prior to Their Release for Assembly Operations*

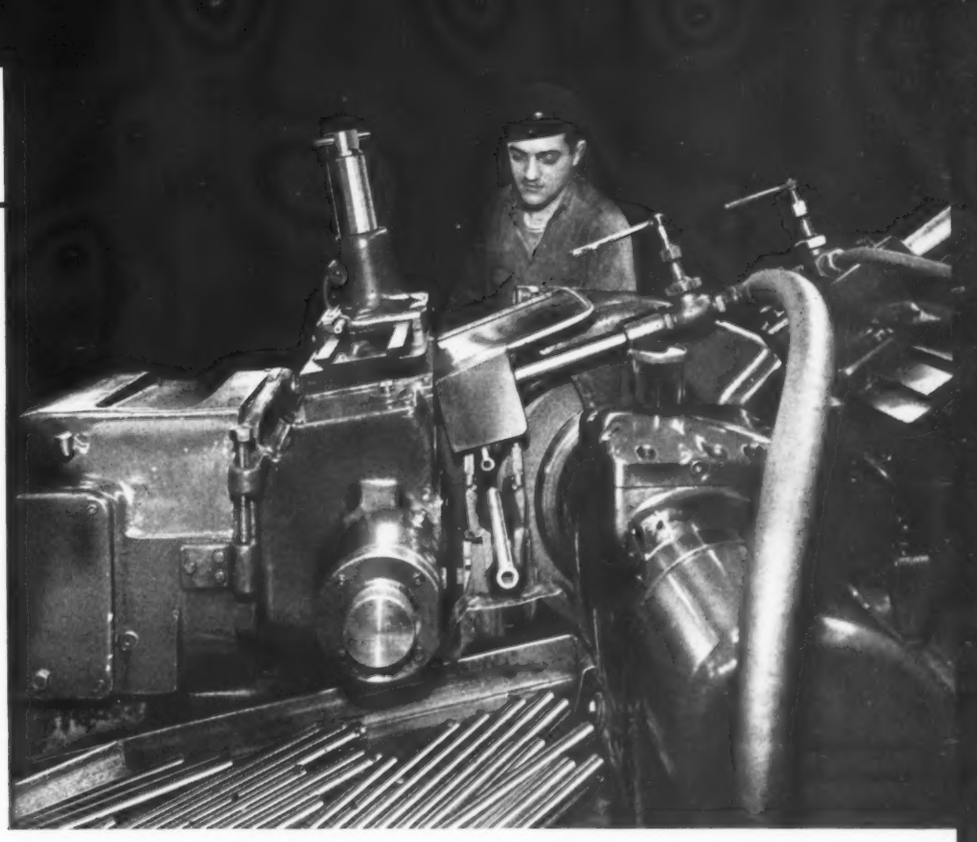

*Fig. 23. Rocker-arm Shafts up to 36 Inches Long are Ground to the Specified Diameter within 0.0005 Inch for Their Full Length*

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outside diameter of approximately 2 7/8 inches. About 0.020 inch of stock was ground from each side of the gears, and they were brought to the specified width within 0.001 inch. Sometimes as many as three hundred gears are loaded on the magnetic chuck at one time.

The same machine is used for grinding brass pump spacers which, of course, cannot be held stationary on the table by means of the magnetic chuck. In handling these parts, it is the practice to place steel blocks on the magnetic chuck around the outside and inside of the brass pieces. When the steel blocks are magnetized, the brass pieces are held securely in place.

Rocker-arm shafts approximately 1 1/4 inches in diameter are being finished by the Cincinnati centerless grinding machine illustrated in Fig. 23. The particular pieces shown are 16 inches in length, but sometimes rocker-arm shafts as long as 36 inches are handled by this machine. They are ground to size within 0.0005 inch for their entire length.

*Fig. 24. "Defender" Engines are Assembled on a Line along which Bins of the Engine Parts are Located beside the Various Stations*

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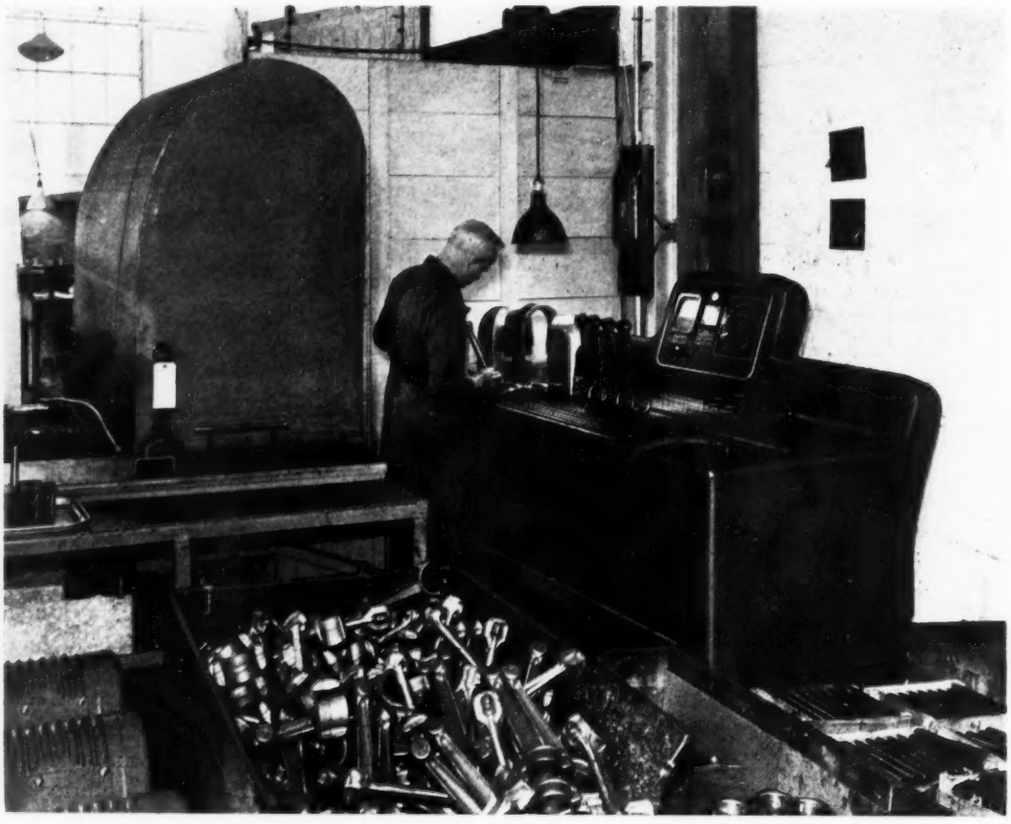


*Fig. 25. Magnaflux Inspection is Performed on a Considerable Number of Steel Parts that Enter into the Construction of "Defender" and "Invader" Engines*

Many of the steel parts that go into "Defender" and "Invader" engines must pass a Magnaflux inspection, some of them in both the rough and finished stages. A view of the Magnaflux inspection machine is presented in Fig. 25, which shows the inspector engaged in checking finished connecting-rods. This equipment is of the type in which a solution of iron oxide is sprayed all over the magnetized work-pieces to show up otherwise invisible defects, such as cracks or similar flaws at or near the surface. Magnetizing and demagnetizing devices are seen at the left-hand end of the machine. In addition to connecting-rods, such parts as wrist-pins, pump-shafts, and crankshafts must pass a Magnaflux inspection.

Final dimensional inspection of all parts is performed in a department that is separated from the remainder of the shop to promote cleanliness and eliminate noise. A view of some of the inspection benches in this department is seen in Fig. 22. Overhead cranes equipped with electric or air hoists facilitate the handling of heavy parts.

In the final assembly, the engines are moved progressively to various stations arranged in a straight line. Fig. 24 shows a general view of the line in which "Defender" engines are assembled. When the engines reach the end of the assembly line, they are transferred to a modern test room, where they are given a ten-hour inspection on a dynamometer. The engines are then completely disassembled, all parts are inspected for defects, valves are reground if necessary, and any other corrections made, after which the engines are reassembled and given a final two-hour test run.

During these tests, records are made of horsepower readings at various speeds, of fuel and oil consumption, and of water and oil temperature. An exhaust system, to which all engines under test are connected, carries the heat, gas, and noise resulting from the test to the outside of the building.

# Gage Designed for Sizing Ball Races of Gun Turrets

By KURVIN STRAYER

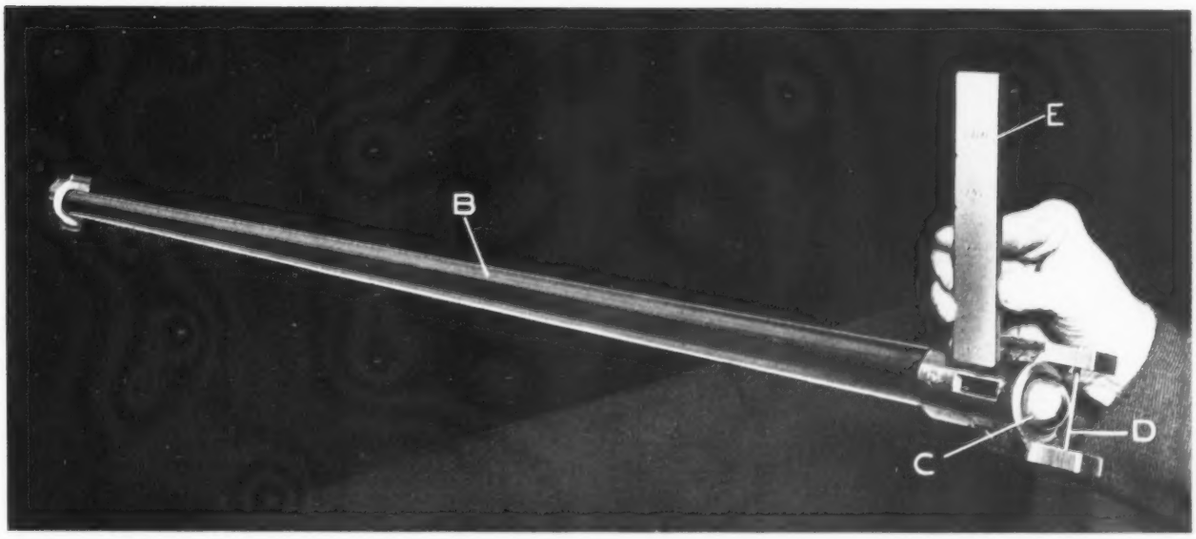
**Approved for Publication by the War Department**


*Fig. 1. Method of Using Floating Type Gage in Checking Diameter of Ball Race in Gun Turret*

THE machining of the ball races in turrets for tank, anti-aircraft, or other guns mounted on revolving turrets requires considerable skill and extreme accuracy with respect to dimensions, in order that the mating races will fit properly when assembled. As the ordinary machine shop gages cannot be employed on this job, the attainment of the required accuracy is a difficult matter.

In order to facilitate the sizing of ball races on a large quantity of tank turret rings, the writer designed and put into use a special floating ball type gage which is now giving satisfactory results. This gage is described and illustrated here with the hope that it can be put to

*Fig. 2. Equipment Designed for Gaging Diameter of Ball Races in Gun Turrets*



good use by the many manufacturers now engaged in the large-scale manufacture of similar rings.

The gage, which is shown in Fig. 2, is used in the finishing operation on the lower turret ring ball race in the manner indicated in Fig. 1. The basic purpose of this gage is to give the operator a simple means of machining the 1 1/4-inch radius groove at *A*, Figs. 1 and 3, to the exact diameter and height. The gage-bar *B*, Figs. 1 and 2, is made of 1-inch extra heavy pipe, the ends being turned to receive the fork-shaped fittings. These fork fittings are milled to allow a 1 1/4-inch ball to come in contact with the groove at the proper elevation. The ball at the far end from the hand, Fig. 2, is pressed against a seat in the end of the pipe or bar *B*. The 1 1/4-inch ball *C* shown below the hand is free to move in and out, but is prevented from falling out by a 1/8-inch round pin *D* between the side pieces forming the fork. The stepped gage *E* is inserted in the rectangular slot to move ball *C* outward against the work, so that it will seat perfectly in the raceway or groove *A*, as indicated in the cross-section view of the race and fixture, Fig. 3.

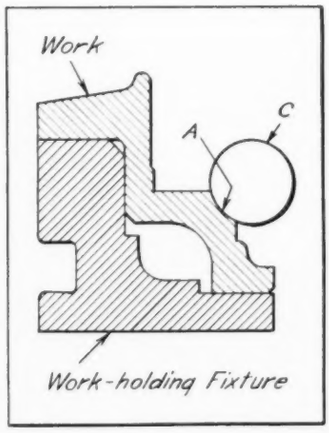



*Fig. 3. Cross-section of Ball Race and Fixture Shown in Fig. 1*

The gage, in being applied, is moved back and forth in the plane of the race until accurately located in the central position. Gage *E*, which is stepped in increments of 0.005 inch, beginning with 0.980 inch and terminating at 1.000 inch, is now inserted in the slot. If the smallest step on the gage just passes through the slot, it is obvious that the diameter of the race *A* must be increased 0.020 inch by further machining, since this step is 0.020 inch smaller than the step of the gage which gives the size desired. With this small amount of 0.020 inch of material left to be removed, the operator might easily remove too much material if means were not provided to show when the groove has reached the required diameter. For this purpose, a dial indicator is clamped to the cross-rail of the machine with its spindle against the saddle. Then, on resuming the machining operation, the indicator reading is followed closely and is used as a guide in removing the amount of material required to obtain the finish size.

With slight alterations or the elimination of the fork ends, the type of gage described could be used in performing boring operations on cylinders, etc., and in determining the amount to be removed when the sizes are beyond the range of inside micrometers ordinarily available.

★ ★

*Twenty-five-pounder Guns Outside a Plant in Australia where they were Manufactured. The Australian Munitions Industry is Turning out Almost Every Kind of War Equipment*

# Keeping the New York Central's Four Thousand Locomotives Running

By CHARLES O. HERB

*Fig. 22. Air-operated Device that Facilitates the Loading and Unloading of Locomotive Truck Wheels on a Vertical Boring Mill*

OPERATIONS performed on modern machine tools and other metal-working equipment in the production of parts required for the maintenance of the New York Central's locomotives, were described in the first and second installments of this article which appeared in April and August MACHINERY. This, the final installment, will describe additional operations in the Beech Grove and Collinwood shops of the New York Central Railway System.

An ingenious device that greatly facilitates the loading of heavy truck wheels on a vertical boring mill and unloading them at the end of the operation is illustrated in Figs. 22 and 23. This device consists essentially of a vertical air cylinder (seen in front of the machine), which is fitted with a piston and a rod to which a horizontal beam is attached. Hooks are provided at the ends of the beam for lifting the wheels. Several feet in front of this cylinder is a second air cylinder, which can be clearly seen in Fig. 23. Attached to the piston-rod of this cylinder is a tilting table that is operated by links, the bottom ends of which are connected to floor brackets. When the piston is in its lowest position, the table is almost vertical, with one end resting on a floor-plate. When the piston is raised to its highest position, the table is elevated, and at the same time, tilted back until it is in the position seen in Fig. 23.

When an operation is in progress on the boring mill, the piston of this cylinder is in its lowest position, so that a wheel can be rolled against the table and on the two projections at its bottom end in the manner shown in Fig. 22. The swinging beam of the other cylinder is held in the identical position shown, so that its hooks

*Fig. 23. (Left) Equipment Shown in Fig. 22 being Used for Transferring a Wheel from the Lifting Table to the Machine and Vice Versa*

*Fig. 24. (Below) Machine Employed in Welding "Safe Ends" to Boiler Flues and Superheater Tubes. Air-operated Equipment Loads the Tubes into the Machine and Unloads them*

cannot dangle against the revolving machine table and the work.

As soon as the operation is completed and the boring mill has been stopped, the operator moves a valve adjacent to the right-hand cylinder to actuate the piston in the other cylinder, thus raising the table with the truck wheel into the position shown in Fig. 23. Then he swings the transfer beam around by hand, so that the hooks at one end can be attached to the wheel that is on the boring mill and the hooks at the opposite end to the wheel that has just been raised from the floor. The operator then moves a second valve, which actuates the beam piston and lifts the two wheels, as illustrated.

The beam, with the two wheels, can then be readily swung on its pivot to place the rough wheel over the machine table and the finished wheel over the tilting table. By reversal of the control valves, the rough wheel is then lowered on the machine table and the finished wheel on the tilting table. After the hooks have been detached from the wheels and the beam returned to the position shown in Fig. 22, a valve is operated, which causes the tilting table to move down and deliver the finished wheel to the floor.

The weight of the wheels holds the hooks locked when the wheels are lifted. The lever used to close the hooks against the wheels and release them is engaged with a slot in a bracket to hold the beam in the idle position.

Air cylinders have also eliminated the arduous work ordinarily required in boiler-flue and superheater-tube reclaiming operations in which "safe ends" are welded to the ends of flues from which the worn out section has been cut off. In the Collinwood shop, the equipment seen in Fig. 24 automatically loads flues or tubes into a Swift butt-welding machine for welding the "safe ends" to them, carries the flues through

*Fig. 25. Another View of the Boiler-flue and Superheater-tube Handling Equipment, Showing the Long Horizontal Air Cylinder that Actuates the Tube Carriage*

the sequence of operations, and finally unloads them. The operator manipulates six levers and four pedals at the front of the machine to actuate the various movements.

The flues are loaded on the rack seen in the left background and roll to the front of the rack. As each flue reaches the front position, it is retained by fingers at both ends until the preceding operation is ended. Then two air cylinders are operated to raise arms which lift the front tube on the rack higher than the retaining fingers in the manner shown in Fig. 25. The front tube now rolls forward on these arms into position above rollers mounted at both ends of a carriage. The rollers are directly in line with the welding machine.

When the operator actuates a valve, the arms return to the position shown in Fig. 24 and lower the flue on the rollers of the carriage. With the operation of another air valve, the tube

*Fig. 26. Multiple-punching and Spacing Machine or Duplicator by Means of which Steel Plates for Railway Cars are Punched and Cut out in Accordance with Templets*

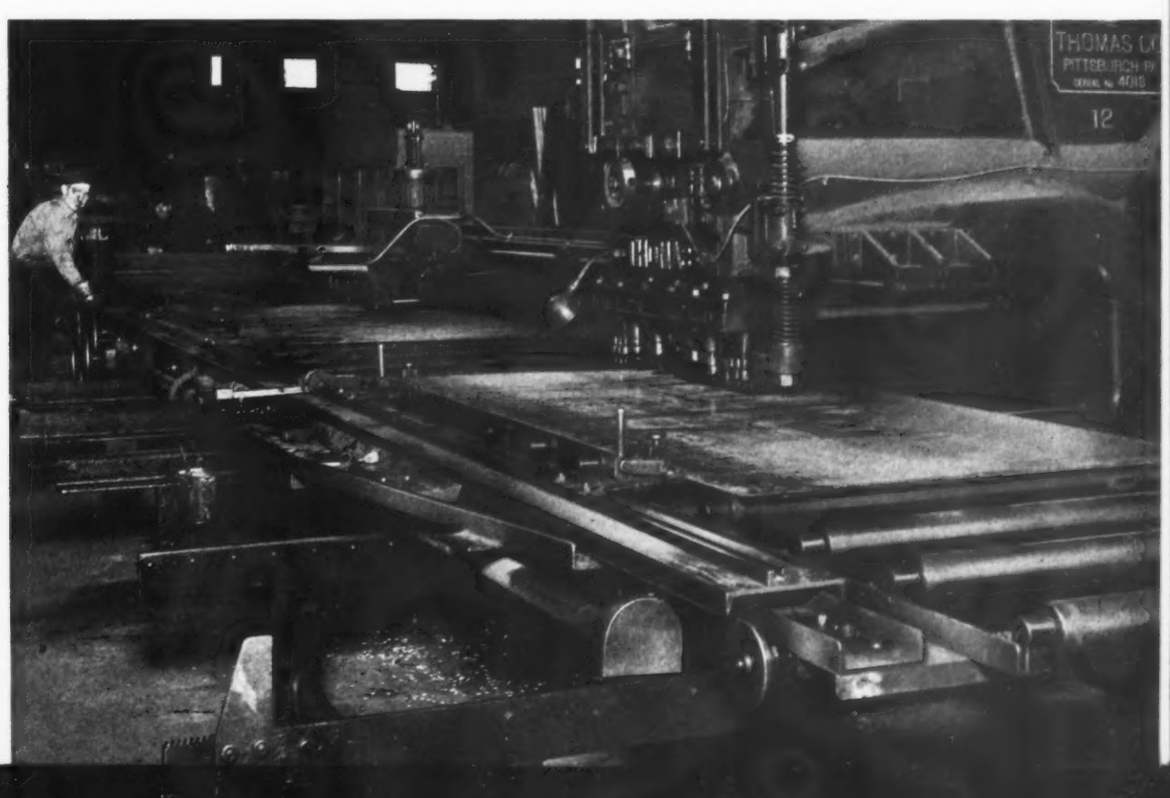


*Fig. 27. Air-operated Clamping Arrangement Applied to a Shaper that is Used for Finishing the Joint Surfaces of Crown Bearings*

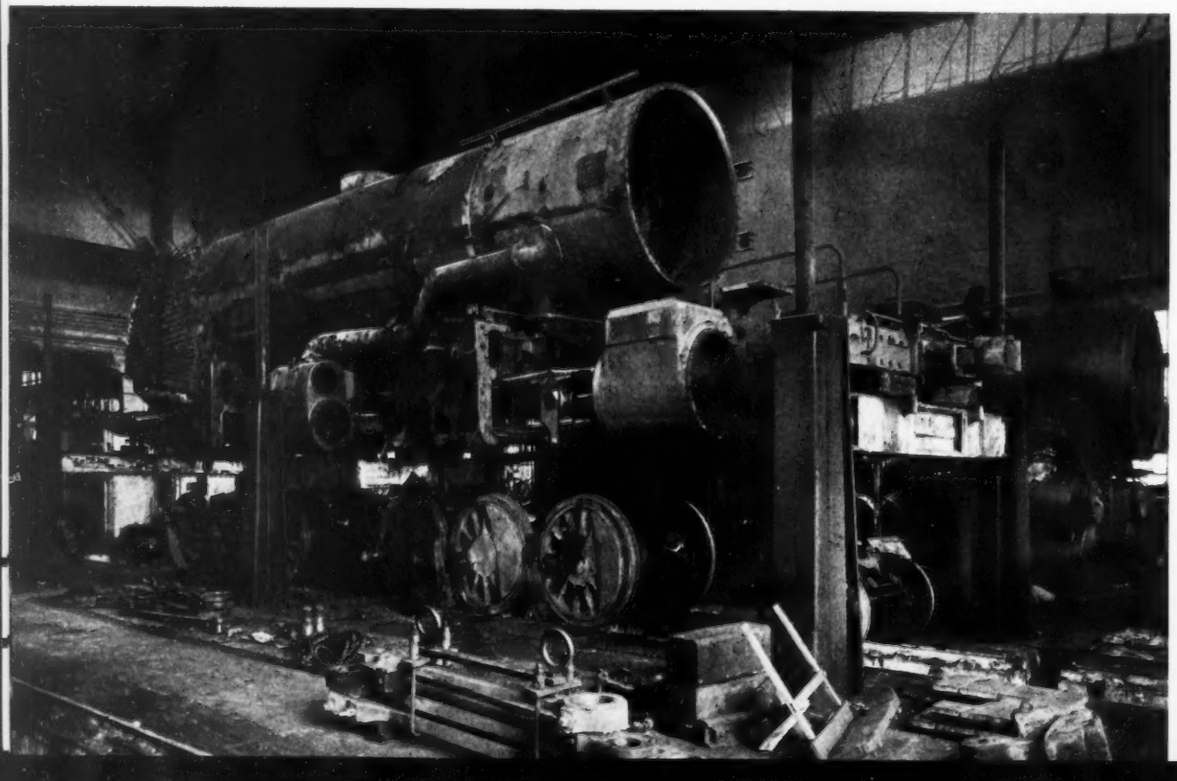
*Fig. 28. Large-capacity Screw Jacks Used in the Locomotive Dismantling Shop for Lifting Locomotives from the Driving Wheels and Trucks to Facilitate Removal of the Wheels*

is clamped between jaws in the center of the carriage. The operator then moves a lever to actuate the piston in the long horizontal cylinder seen in Fig. 25, which pushes the carriage toward the welding machine, bringing the flue into contact with a "safe end."

This "safe end" is gripped between air-operated jaws, and the front end of the flue is gripped by a second pair of air-operated jaws. The slide on which the second pair of jaws is mounted moves forward under hydraulic power to push the flue firmly against the "safe end." The operator then presses a button to turn on electrical current for the welding. While the operation is in progress, compressed air is directed through the flue from the end in the welding machine to prevent the formation of scale on the inside of the weld.

When the welding has been completed, the piston in the horizontal cylinder at the back end of the carriage is again actuated to advance the flue over an arbor, which supports it while it is revolved between three rollers that insure a smooth external surface around the weld. At the end of this operation the carriage withdraws with the flue, and the lift arms at the front of the flue rack rise, so that the welded flue can roll to the pile at the front of the equipment, thus completing the sequence of operations. The illustration shows superheater tubes 5 3/8 inches in diameter being handled. The length of the "safe ends" ranges from 12 to 24 inches.

Another machine shop application of an air cylinder is presented in Fig. 27. In this instance, a cylinder is applied to a shaper for clamping crown bearings in a V-block on the table so as to hold them securely while the joint faces are being finished. A long bar that is pivoted at the back end of the fixture is lowered on the crown bearing after it has been properly seated in the large V-block as determined by means of a gage.



The front end of this lever is supported in a yoke attached to the piston-rod that extends vertically from the air cylinder at the front of the shaper knee, and a pin is inserted horizontally through holes in the jaw above the lever. When air is admitted into the cylinder above the piston, the front end of the clamping lever is pulled down, holding the work securely in place.

The preparation of large steel sheets used in building freight and coal cars in the Beech Grove shop is aided by the use of the Thomas "Duplicator" punching and spacing machines seen in Fig. 26. The punching machine, which is seen in the foreground, is provided with a series of round and square punches, any of which can be actuated at the will of the operator by inserting the corresponding feeler plug on the spacing machine in a hole in a templet sheet at the left-hand end of the table. After he has located the feeler plug over the proper hole in the templet sheet by manipulating the table in and out, or to the right or left, he depresses a foot-pedal, which operates a solenoid switch and causes the feeler to descend into the templet hole. The corresponding punch on the punching machine is then operated.

The templet sheet is provided with the same number of holes as are required on the sheet being punched, and the sheets are of equal size. Both the templet and the sheet being punched are clamped to a beam that extends the full length of the roller table and is actuated lengthwise by a handwheel. In-and-out movements of the table are effected by a second handwheel. Sheets up to 9 1/2 feet long and 5 feet wide can be accommodated. The punching machine was provided with eight round punches and three square punches at the time that the operation was photographed.

When repairs must be made on locomotives that require the removal of the wheels, it is necessary to lift the boiler, with many heavy parts attached—such as cylinder castings, crossheads, valve gear parts, and bumpers—sufficiently to permit the wheels to be rolled from under. The lifting of the locomotives is effected in most shops by the use of overhead cranes. In addition to cranes, the Collinwood shop has been provided with Whiting jacks, such as seen in Fig. 28.

In the operation illustrated, three beams are supported by six jacks—three on each side of a dismantling pit. Each jack is actuated by a 5-inch lead-screw which engages a nut on the corresponding end of the lift-beam. The lead-screws can be operated simultaneously or individually for raising the three lift-beams and their load. The central beam has a lifting capacity of 300 tons, while both end beams have lifting capacities of 150 tons each. A 50-H.P. motor drives the screws.

# Machine Tool Builder Provides Housing Facilities for Employes

DUE to the great increase in the number of employes in many plants throughout the country, the problem of adequately housing the workers has become a serious one, especially in medium-sized and small communities. The Cone Automatic Machine Co., Windsor, Vt., has taken steps to meet this problem in a manner that has proved quite effective.

Many of the new workers in this plant are drawn from the surrounding towns and farms, where they still maintain their homes; but to come to work each day from their homes may require traveling as much as thirty miles in each direction. For these men, the company has provided dormitories having simple but well-furnished single rooms which they occupy during the week, while they usually return to their homes over the week-end. These dormitories are provided with all necessary conveniences and with a reading room, writing tables, magazines, etc. For the occupancy of these dormitory rooms, a very nominal charge is made by the week.

The company has also undertaken a housing development and is building a large number of houses which are to be sold to the workers at cost. It is surprising to note the low price at which attractive homes can be furnished to the workers in this way. These homes are located outside of the town itself, but have the advantage of all town facilities—water, sewers, electricity, and fire protection. By locating them outside of the town, it has also been possible to build them on good-sized lots, enabling the workers to raise vegetables on their own land.

The company does not employ a contractor in building these homes, but maintains its own crew of building construction workers. These men are steadily employed the year around, since at times they are engaged in building additions to the company's shops and at other times in the home-building activity.

# Reducing Truck-Wheel Costs by Arc Welding

By G. G. LANDIS, Chief Engineer
The Lincoln Electric Co., Cleveland, Ohio

UNDER the existing war conditions, considerable ingenuity must be exercised to overcome the handicaps imposed by shortages in material and labor in order to maintain production. Arc welding provides one means of meeting these difficulties by making it possible to fabricate many types of machines and devices from materials readily obtainable, such as scrap pipe. The wheels used on trucks and similar equipment for transporting materials within manufacturing plants, for example, can be produced by assembling scrap pipe by arc welding. Although at first it might appear that a wheel would be a difficult piece to make, a closer study of the problem shows that the opposite is true, and that considerable savings can be obtained by producing wheels in this manner.

Three types of truck wheels are shown in Fig. 1. The relative costs of the wheels can be compared by referring to the accompanying table. It will be noted that the wheel shown at *B*, which is fabricated by means of arc welding, costs 38 per cent less than the one shown at *A*, which was made by the previously employed method. This difference in cost is due to the reduction in weight of material and the fact that the material used is lower in price. The arc-welded wheel shown at *C* is still less expensive because of the simplified design. In this case, the cost is about 50 per cent less than for the wheel shown at *A*, and about 20 per cent less than for the arc-welded design shown at *B*.

The arc-welded wheel *B*, as shown in Fig. 2, has a rim formed by rolling a structural steel channel into a circle and then butt-welding the ends together. The rim is then clamped in a jig,

Chart Showing Weight and Cost of Truck Wheels A, B, and C, Fig. 1

| | A | B | C |
|---|---|---|---|
| Weight, Pounds.. | 17.5 | 12.5 | 11.0 |
| Material..... | Casting | Steel | Steel |
| Cost of Material.. | $0.875 | $0.33 | $0.29 |
| Cost of Labor .... | 0.000 | 0.21 | 0.13 |
| Total Cost ..... | $0.875 | $0.54 | $0.42 |

after which a short piece of pipe employed as an axle is centered within the rim. Three pieces of steel bar are then lap-welded to the inside edge of one side of the rim, and fillet-welded to the axle pipe as shown. Three similar bars are welded to form the other spokes for the wheel on the opposite side. Such a wheel is superior in strength to the one shown at *A*, Fig. 1, and weighs 5 pounds less.

As an alternate design for the wheel shown in Fig. 2, in cases where suitable rolling equipment for forming the rim from channel mate-

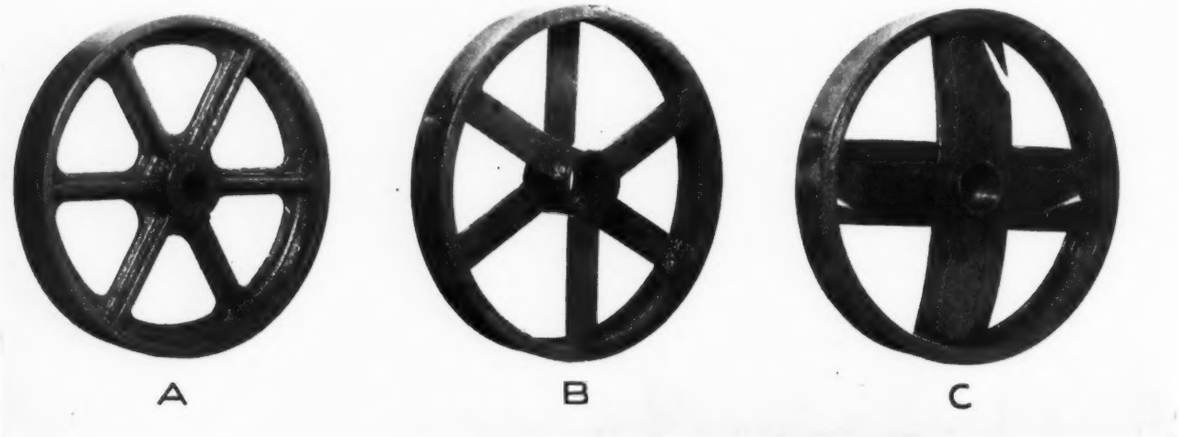



Fig. 1. (A) Cast-iron Truck Wheel. (B) and (C) Welded Steel Truck Wheels

rial is not available, a satisfactory rim can be made by merely cutting off a section of large pipe of the proper diameter, and welding in the spokes and hub, as shown in Fig. 3. The same procedure as previously described may be used in welding the spokes in place, except that the welds on the rim will be of the fillet type, rather than lap welds, due to the absence of an edge or flange, as in the case of the rolled channel rim. Because large quantities of scrap pipe are available, despite shortages of other materials due to the war effort, use of this material is finding increasing favor with welders.

Fig. 4 shows a second type of arc-welded wheel. As shown in this illustration, it is not necessary to use stamped or formed spokes, such as those used in wheel *C*, Fig. 1. Broad flat pieces are drilled to receive the axle pipe, which is welded into the two holes as shown and lap-welded to the edges of the rim. This design is 1 1/2 pounds lighter than the 9 1/2-inch diameter arc-welded six-spoke design. As shown in the illustration, a roller bearing can be inserted in the axle pipe.

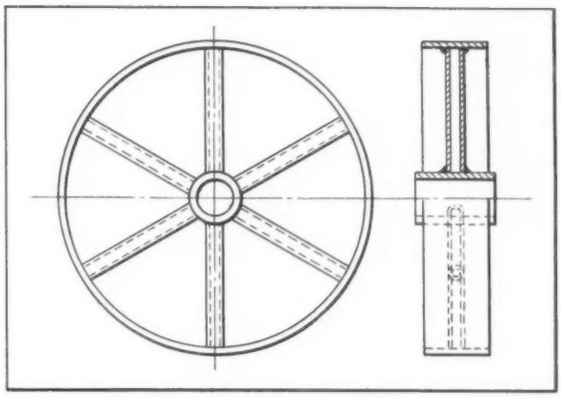


Fig. 6. Truck Wheel Made Entirely of Scrap Pipe by Arc Welding

In Fig. 5 is shown an alternate design for Fig. 4, which can be used when channel-rolling

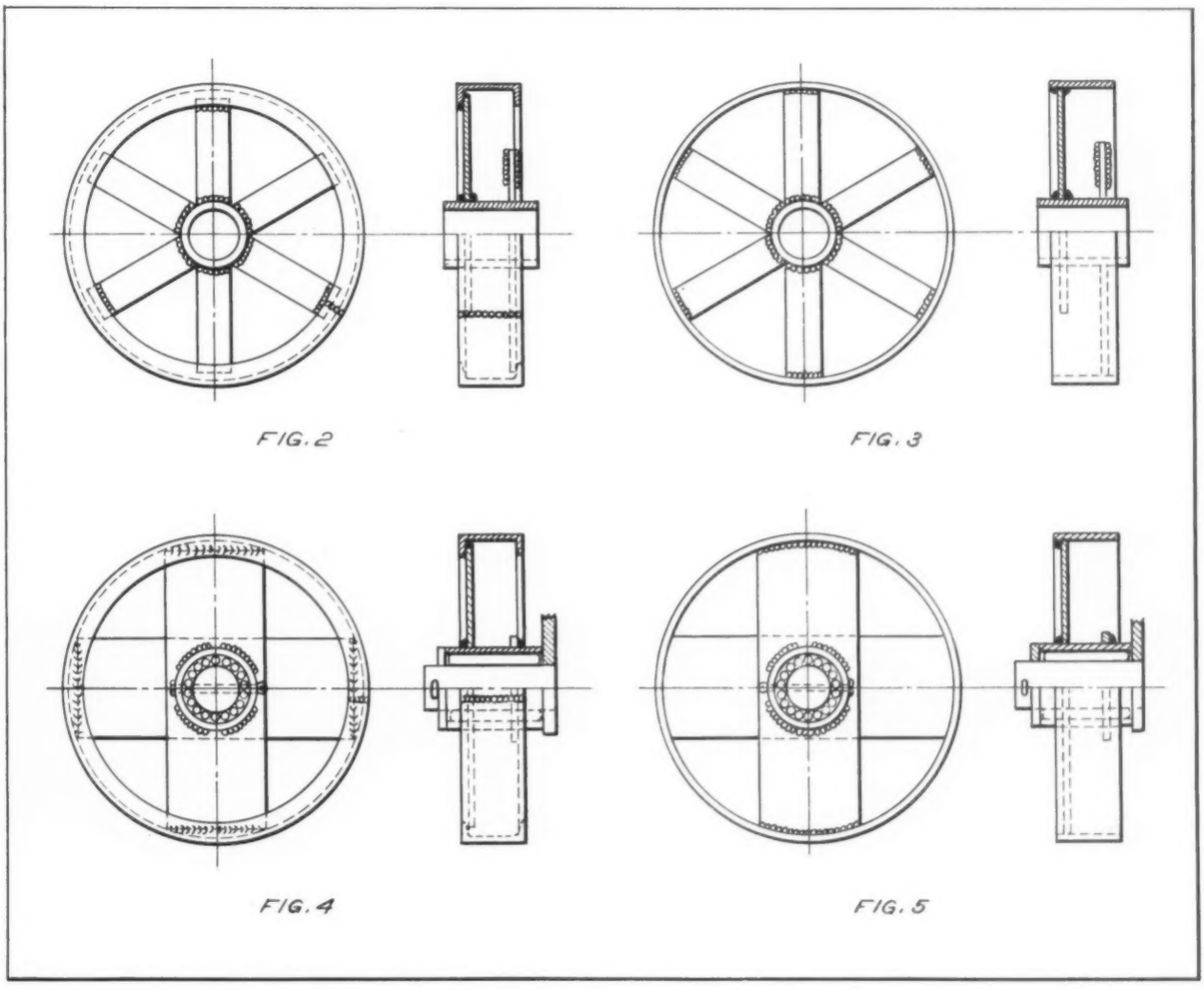



Fig. 2. Arc-welded Wheel with Axle, Rim, and Spokes Fabricated from Pipe, Rolled Channel, and Bar Stock, Respectively. Fig. 3. Wheel of Same Construction as Shown in Fig. 2, Except that Rim is Section of Large-diameter Pipe. Fig. 4. Arc-welded Wheel of Simplified Design with Rolled Channel Rim. Note Roller Bearing. Fig. 5. Wheel Like One Shown in Fig. 4, Except that Rim is Made of Pipe

equipment is not available. The rim can be cut from a pipe of large diameter, as in the case of the wheel shown in Fig. 3. Fig. 6 shows a type of wheel which can be made entirely of scrap pipe. The rim, as in the case of the wheel shown in Fig. 5, is cut from a pipe of large diameter. The hub is also made of a piece of pipe. Pipe smaller in diameter than that used for the hub is employed for the six spokes of this wheel. These spokes are arc-welded to both the rim and the axle to form a strong wheel of good appearance, using no material other than that available on the pipe scrap heap. Because of the flexibility of arc-welding equipment, wheels of the type shown can be made in virtually any size and for a wide range of applications.

* * *

## "Overmotoring" Should be Avoided

"When in doubt, consider the next smaller rating" is the advice given by L. A. Umansky, assistant manager of the General Electric Co.'s industrial engineering department, to those responsible for selecting motor sizes for industrial use. Mr. Umansky states that, because of "overmotoring," probably 25 per cent more material and labor are now going into the production of motors than is needed for the work that the motors are called upon to do. Motor users can help greatly in conserving materials, and can aid motor manufacturers in producing the maximum number of motors for the war effort, by selecting motor sizes on the basis of actual expected duty, without stressing additional safety factors to take care of unexpected heavy loads. The use of over-size motors may be commendable in normal times, but the practice should be discarded during the war. It should be remembered that the manufacturer has already designed into the motor a margin of safety to meet reasonable overloads.

* * *

## Drop-Forgings in the War Production Program

Like so many other metal products, drop-forgings play a most important part in the war production program. The Drop Forging Association, with headquarters at 605 Hanna Bldg., Cleveland, Ohio, publishes helpful information in its monthly publication *Drop Forging Topics*, the purpose of which is to show manufacturers of war implements, and of equipment used for the production of war material, how to speed up the production and finishing of forgings, how forgings save and conserve metal, and how time can be saved and machine capacity increased by using forgings made to close tolerances.

## Unexpected Results from Salvage Drive

The drive to recover and salvage industrial materials in the automotive industry brought about an unusual development in one of the plants. In connection with the salvage program, a machine was developed that promises to become standard equipment with many different applications.

When the salvage crews transported obsolete equipment to the scrap pile near the factory railroad siding, the plant pavements and cinder roadways became littered with bits of metal. Because these metal pieces had sharp edges that endangered rubber tires, the salvage crew devised and built a vehicle that they called the "scavenger." This vehicle was built like a small wagon, and fitted with four steel-rimmed wheels retrieved from some abandoned farm machinery. It was provided with a rebuilt automobile engine driving an electric generator. The generator provided power for an electromagnet which, salvaged from an abandoned foundry crane, was suspended from the rear of the wagon. Pulled by a farm tractor, this vehicle followed every scrap-hauling truck and picked up the iron and steel fragments with its magnet.

Shortly after it had been placed in operation, its unexpected value was discovered. There was a sudden decline from an average of thirty punctures a month in the tires of combat vehicles which the company is manufacturing for the Army. It was discovered that the scavenger not only picked up the scrap pieces that were strewn about because of the salvaging drive, but that it also picked up from the cinder roadways innumerable nails, screws, and other small objects of iron or steel.

The vehicle was then operated on a continual basis all over the premises. It was run repeatedly over the lots where the army trucks were parked, ready for delivery. There has not been a puncture since its use was inaugurated. The device has been so satisfactory as a means of conserving rubber that a more effective "scavenger" is now being built, equipped with three new and much more powerful magnets, which will sweep a 9-foot path in each passage.

* * *

## Machine Painting Done Automatically

A robot painter that automatically sprays the parts used in aircraft assemblies has been installed by one of the large aircraft manufacturers. The device is operated by five men and does, in a third of the time, the work that it formerly required fifteen men to do. Ten men needed for other work have thus been released from hand-operated spray guns.

# MACHINERY'S DATA SHEETS 473 and 474

## BRONZE SPECIFICATIONS TO GOVERNMENT REQUIREMENTS—1

| Type of Bronze | Chemical Composition (Per Cent) | Designation | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Federal | Navy | Air Corps | AMS[1] | SAE[2] | ASTM[3] | Ampco[4] |
| Rolled, high-iron type, aluminum bronze | Fe. 2.75–3.5<br>Al. 9.0–10<br>Others—0.4 max.<br>Cu.—Balance | QQ-B-666 Grade B | 46–B–17b Grade B | ..... | 4635 | 701 | ..... | Ampco 16 rolled—extruded |
| Cast, high-iron type aluminum bronze | Fe. 2.5–3.25<br>Al. 8–9<br>Others—0.4 max.<br>Cu.—Balance | QQ-B-671a Class A | 46–B–18c | ..... | 4870 | 68A | B-148-41T Alloy 9A-1 | Ampco 12 or Ampcoloy 521 |
| Cast, low-iron, aluminum bronze, 89–10–1 type | Al. 9–10<br>Fe. 1.00 max.<br>Imp. 0.5 max.<br>Cu.—Balance | QQ-B-671a Class B | ..... | ..... | 4830 (Forged) | 68B | B-148-41T Alloy 9B-2 | Ampcoloy A-323 |
| Standard or low-tensile manganese bronze | Cu. 56–59<br>Mn. 0.1–0.5<br>Al. 0.75–1.50<br>Fe. 0.75–1.50<br>Zn.—Balance | QQ-B-726a | 49–B–3e | ..... | 4860 | 43 | B-147-41T Alloy 8A | Ampcoloy 62 |
| High-tensile type manganese bronze | Cu. 61–68<br>Mn. 2.5–5.0<br>Al. 3–6<br>Fe. 2–4<br>Zn.—Balance | WXS-5-"A" Rev. 2 | Modified 46–B–29 Grade A | ..... | 4862 | ..... | B-147-41T Alloy 8B | Ampcoloy 66 |
| Medium-strength manganese bronze | Cu. 61–68<br>Al. 3–6<br>Mn. 2.5–5.0<br>Fe. 2–4<br>Zn.—Balance | WXS-5-"B" Rev. 2 | Modified 46–B–29 Grade B | ..... | ..... | ..... | ..... | Ampcoloy 64 |
| Valve bronze for pressure work | Cu. 86.5–91.0<br>Sn. 5.5–6.5<br>Pb. 1–2<br>Zn. 1.5–5.0 | QQ-B-691a Comp. 1 | 46–B–8g | ..... | ..... | ..... | B-143-41T Alloy 2A | Ampcoloy 71 |
| Red brass | Cu. 84–86<br>Sn. 4–6<br>Pb. 4–6<br>Zn. 4–6 | QQ-B-691a Comp. 2 | 46–B–23c | 11306 Grade A | ..... | ..... | B-145-41T Alloy 4A | Ampcoloy 74 |

[1] Aircraft Materials Specifications. [2] Society of Automotive Engineers. [3] American Society for Testing Materials. [4] Ampco Metal, Inc.



## BRONZE SPECIFICATIONS TO GOVERNMENT REQUIREMENTS—2

| Type of Bronze | Chemical Composition (Per Cent) | Designation (See Data Sheet No. 473) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Federal | Navy | Air Corps | AMS | SAE | ASTM | Ampco |
| Gun-metal 88–10–2 or Navy composition "G" | Cu. 86–89<br>Sn. 7.5–11<br>Zn. 1.5–4.5<br>Pb. 0–0.3 | QQ-B-691a Comp. 5 | 46-M-6g | 11306 Grade B | ..... | ..... | B-143-41T Alloy 1B | Ampcoloy 72 |
| Leaded gun-metal | Cu. 85–89<br>Sn. 7.5–11<br>Zn. 1.5–4.5<br>Pb. 0–1 | QQ-B-691a Comp. 6 | 46-B-5h | ..... | ..... | 63 | ..... | Ampcoloy 72 |
| High-lead bronze | Cu. 73–80; Sn. 5–7<br>Pb. 15–20 | QQ-B-691a Comp. 7 | 46-B-22d Grade I | ..... | ..... | ..... | ..... | Custom Made |
| Phosphor-bronze modified | Cu. 82–85; Sn. 7–9<br>Pb.7-9; Phos.0.3-.6 | QQ-B-691a Comp. 8 | 46-B-22d Grade II | 11306 Grade C | ..... | ..... | ..... | Ampcoloy 31 |
| Soft bronze alloy | Sn. 4.5–5.5<br>Pb. 22–24<br>Cu. 70–73 | ..... | 46-B-22d Grade V | ..... | 4840 | ..... | B-144-41T Alloy 3E | Ampcoloy 34 |
| Heat-treated, hard aluminum bronze | Al. 10.5–11.2<br>Fe. 3.3–4<br>Others—0.4 max.<br>Cu.—Balance | ..... | ..... | 11076 | 4871 | ..... | ..... | Ampco 18–22 |
| Curtiss-Wright Spec. 3300 | Al. 10.5–11.2<br>Fe. 3.3–4<br>Others—0.4 max.<br>Cu.—Balance | QQ-B-671a Class D | ..... | ..... | ..... | ..... | ..... | Ampco 18–23, or Ampcoloy 581–23 |
| Hamilton Standard PWA 241 | Fe. 3.3–4<br>Al. 10.5–11.2<br>Others—0.4 max.<br>Cu.—Balance | QQ-B-671a Class C | ..... | ..... | ..... | ..... | B-148-41T Alloy 9A-2 | Ampco 18 or Ampcoloy 581 |
| Forged aluminum bronze with nickel and manganese | Cu. 78–84<br>Al. 9–11<br>Fe. 2–3.5<br>Ni. 4.5–5.5<br>Mn. 0.5–1.5 | ..... | ..... | 11076 | 4640 (forged) | ..... | ..... | Ampcoloy 45 |
| Hard bronze | Cu. 86–89<br>Sn. 9–11; Zn. 1–3<br>Pb. 0.20 max. | ..... | ..... | ..... | 4845 | 62 | B-143-41T Alloy 1A | Ampcoloy 79 |

# Speeding up the Seasoning of Castings

**Suggestions Based on the Experience of a Number of Leading Machine Tool Builders**

At this period of greatly accelerated production, it is obvious that castings can no longer be seasoned by being stored in the shop or in the yard of a plant for several months. Various methods are being used to accelerate the seasoning process.

In one well-known machine tool plant, large castings are being seasoned by an unusual method. After the castings have been rough-machined, they are suspended from a crane and are pounded with wooden blocks. The vibration caused by successive shocks seems to relieve all the strain. A metal object cannot be used for the pounding, as this would peen the surface of the casting. In this company's experience, the method has proved satisfactory in almost every instance; it has not been applied to smaller castings, because difficulties are seldom met with in the use of smaller castings, even if not seasoned.

If the castings are of heavy construction, they are not so likely to spring out of shape. Many modern machine beds, therefore, are exceptionally well ribbed, and long seasoning is not required. In such cases, a roughing cut is taken on some of the longer beds, and then they are permitted to lie around for a week or two before finishing; but generally, this has not been found to be absolutely necessary.

Some small castings, because of their light construction, must be treated to relieve the strains. In such cases, heat-treatment is resorted to. It is the practice in one plant, to heat these castings to about 950 degrees F. in a furnace and allow them to cool gradually. One heating and cooling cycle has been found to accomplish the purpose.

Another company, known for its high grade of workmanship, writes as follows: "We make it a rule in the foundry to leave all castings in the mold until they are thoroughly cooled. This practice has been followed in the past and is being maintained today, even when it means a delay of a couple of days.

"In proportioning the metal thicknesses in our castings, we are always careful to avoid sudden changes in section. The cooling rate of the metal in the mold is then more nearly uniform, thereby minimizing the residual strains in the casting.

"In some instances, we machine extra surfaces on a casting to help neutralize the strains. For instance, on our bed castings for planers and planer type milling machines, we machine two strips on the bottom of the bed which are directly below the finished ways on the top side of the bed. The width of each strip is about the same as the width of the way. This machining on the bottom is done to neutralize any strains which may be set up in the casting due to removing the scale.

"Such castings as the spindle-carrier for milling heads have two roughing cuts taken on the flat surfaces; then they are rough-bored and drilled; then finish-planed; after which they are finish-bored. This schedule of operations increases the machining, set-up, and handling time, but results in a more accurate job.

"Sometimes we have a casting for a precision jig or gage which must be of light weight for ease of handling. Usually, such parts have quite thin and intricate sections which tend to make them dimensionally unstable. For such parts, we make it a practice to first rough-machine, then give the part a stabilizing heat-treatment, and then finish-machine.

"Another point which may be of interest in connection with seasoning is the effect of indirect sunlight on large machines. We have had numerous experiences where an alignment test made in the forenoon varied considerably from an identical test made in the afternoon. When the test was made again the next morning, it agreed with the one made on the previous morning. This difference probably would not occur, or, at least, it would be greatly lessened, in the new windowless plants now being used by some concerns."

Other engineers state that if a casting is properly made and permitted to cool in the mold before being removed, it should not require seasoning. On the other hand, if the casting is removed at a high temperature, objectionable strains are likely to occur. It is found that castings that are quite light need normalizing or heat-treatment, as already referred to.

* * *

## Automotive Industry Salvages Scrap

More than 100,000 tons of metal scrap were shipped from plants of former manufacturers of motor vehicles and supplies in the month of June to steel mills and non-ferrous metal smelters. Of this scrap, iron and steel accounted for 97,500 tons, and non-ferrous metals, 4400 tons. In these figures is included metal obtained from the scrapping of old machine tools.

# Powdered Metals in Machine Design

**Principles Involved in Making Parts from Compressed Metal Powder—Based on the Practice of the Moraine Products Division of the General Motors Corporation**
**Second of Two Articles**

IN the first of these articles, published in August MACHINERY, the general principles involved in the making of parts from compressed metal powder were outlined, the properties and applications of powdered-metal parts were referred to, and the part played by powder metallurgy in the making of babbitted bearings was outlined. The present article will deal with the processing of powdered-metal parts through the shop, and will also cover the procedure in making babbitted main and connecting-rod bearings and the making of gears from powdered metal.

### *Processing Powdered-Metal Parts through the Shop*

When an order for a part is received by the Moraine Products Division of the General Motors Corporation, it passes through the engineering department, where the mixture proportions, briquetting pressures, and sintering conditions are specified. These factors often must be specially developed because of the character of the work. From this information and the drawing of the part to be made, the production engineers determine how powerful a press will be required. They also design and supervise the making of the tools needed. The making of the punches and dies is an exacting task, because after a piece is briquetted, it will expand; and then, during sintering, it may either shrink or grow, depending upon the material from which it is made. The tool designer must compensate for this shrinkage or growth by increasing or decreasing the dimensions of the die.

When the briquetting tools are ready, they are taken to the powder room, which is an area of about 1000 square feet closed off and air-conditioned to control the humidity. This control is necessary because the metal powders have the characteristics of ordinary salt, in that the grains adhere to one another if they have absorbed an excessive amount of moisture. In the powder room, the required metal powders are mixed. Some of the large mixers handle 700 pounds of powder in one batch. This powder is loaded directly into the hopper containers that feed the briquetting machines.

The briquetting tools usually include a die "barrel," which contains the cavity into which the powder is pressed; a lower punch, which forms the bottom of the die barrel cavity and serves as an ejecting punch after the part is formed; a core-rod, extending up through the lower punch and die barrel, which forms the

*When the Parts have been Formed, They are Placed in a Sintering Furnace where the Atmosphere is Controlled to Exclude Oxygen. A Temperature below the Melting Point of the Metal Transforms the Formed "Green" Part into a Hard, Solid Metal Product*

hole in any hollow cylindrical piece; and an upper punch, which forms the top of the die barrel cavity and which produces the necessary pressure on the powder.

The automatic hopper fills the cavity with powder, and the upper punch comes down to compress the material into less than half of its loose volume, the air being forced out through the minute clearance between the punch and the die or barrel.

The pressure by which the powder is compressed into a solid shape may vary from 20,000 to 100,000 pounds per square inch. The presses used range from small, converted pharmaceutical machines to large hydraulic presses. The larger presses move at a very slow rate. This is necessary for two reasons: First, the powder will not flow around corners—it only travels straight up and down; and time must be allowed for the particles to become interlocked and the air to escape. Also, each press cycle has a series of movements, as compared with the simple up-and-down motion of an ordinary punch press.

*After Sintering, the Porous Bearings are "Cold-sized" and Inspected*

### *The Sintering Process*

When the powder has been briquetted, the parts being made appear to be perfectly solid, but pressure of the fingers will again reduce them to a powder. They must, therefore, be sintered in order to bind the particles together. The pieces are moved from the press to the sintering furnaces in containers. Assuming that bronze bearings are being made, these "green" bronze bearings are treated in a controlled atmosphere for a minimum of thirty minutes, which time includes the cooling period. The parts move through the furnace on a conveyor, so that the heating cycles are accurately timed. After sintering, the part has a cellular rather than a solid structure. In the case of bearing bushings, they are brought to exact dimensions after sintering, by a burnishing or sizing operation, which also produces a very smooth finish for efficient bearing performance. Sometimes this operation may be omitted, but, in any event, the bearing passes along to be inspected, and is then impregnated with oil.

The oil impregnation may be done in two ways. The simpler but slower method is to dip the bearings, a basketful at a time, into a vat of hot oil. The faster and more efficient method is to draw the air out of the bearing cavities or pores by vacuum, and then force the oil into the cavities under pressure. Capillary action retains the oil in the pores, the surface openings of which are so small that they are no more visible than the pores in the human skin; yet, pressure or heat produced by friction or otherwise will bring the oil to the surface like skin perspiration on a hot day. The bearing structure performs the function of grease, in that it holds a lubricant in readiness for service at all times.

### *Procedure in Making Babbitted Main and Connecting-Rod Bearings*

In the Moraine Products Division, the work flows the length of the plant in a straight line. The manufacture of babbitted main and connecting-rod bearings, however, is handled separately on three parallel production lines. In the first line, the matrix is applied to a steel strip and sintered. At the beginning of this line, several strips of steel are unrolled from heavy coils, and at the other end they are rolled back into coils again. In passing between these coils, the strips flow through an air-conditioned powder room, where a delicate feeding mechanism coats them with copper and nickel powder to a depth controlled within a thousandth of an inch. This coating is followed by a sintering process in a furnace, producing a solid matrix. The strip is then ready for the next group of operations.

In these operations, performed in the second line, the babbitt coating is applied and the strip is prepared for final forming and machining. In this step only one steel strip is processed at a time, but the process is made continuous by butt-welding the ends of the strips together. The vacuum babbitting machine used is divided into

three compartments, in which (1) the strip is heated; (2) the air is drawn from all the cavities in the matrix; and (3) the matrix is impregnated with babbitt. The machine maintains the desired thickness and grain size while the strip flows along at the rate of 25 feet per minute. At the end of this operation, the strip is automatically cut to the required width and shaved to thickness.

In the third line, the bearings are formed and machined for use in engines and for other applications. Here the strips are blanked, formed into half-shells, chamfered, broached, tin-plated, and diamond-bored to a total tolerance of 0.00025 inch.

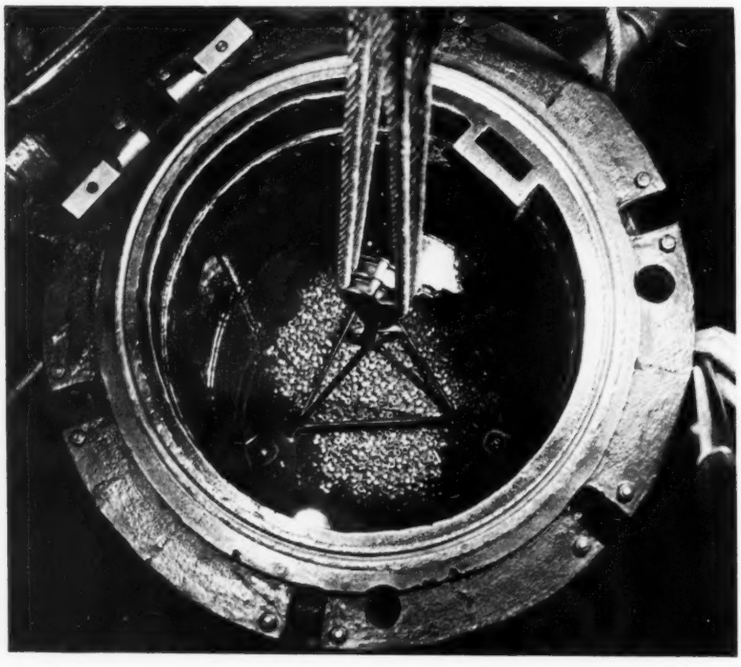
### *Procedure in Manufacturing Powdered-Metal Gears*

An interesting development in powdered metals is the making of oil-pump gears for automobiles. In 1941, all the oil-pump gears used by one large automobile manufacturer were made from molded iron powder. In making the gears, the iron powder is mixed with graphite powder, which latter not only supplies the necessary carbon for the alloy, but acts as a lubricant in molding as well.

The briquetting is done in automatic machines at a pressure of 60,000 pounds per square inch. This pressure is a compromise, in order to obtain, on the one hand, long life of the dies, the wear of which increases with increasing pressures, and, on the other, strength of the gear, which, within certain limitations, increases with rising pressures. The die parts —that is, the die barrel, upper punch, stripping punch, and pilot—are made from hardened tool steel. The most rapid wear is on the die barrel. A very smooth hand-lapped surface finish on the die barrel not only increases its life by reducing wear, but is essential to obtain a fine surface finish on the gear teeth.

After being briquetted, the gears are sintered in a continuous electric furnace—a modified brazing furnace with a partially burned natural gas atmosphere. The sintering temperature is as high as the heating elements will permit, since the time of heating should be kept as brief as possible, both for the sake of economy and in order to reduce and control the amount of shrinkage. The shrinkage in iron parts is held to less than 1/2 per cent. On the other hand, an increase in the sintering time and temperature aids the diffusion of the carbon and improves the mechanical properties; hence, the sintering time is again a compromise to obtain the best all-around results. It varies for these gears from 20 to 40 minutes at a temperature of about 2000 degrees F.

As the sintered gears emerge from the cooling zone of the furnace, they are impregnated with oil and are then ready for use. The tooth surfaces are not machined or finished after sintering. The finishing operations consist of burnish-broaching the hole, machining the outside of the gear, facing the hub to correct length, and chamfering the teeth. In each case, only a few thousandths of an inch of metal is removed.



*The Next Step is to Immerse the Porous Bearings in a Bath of Oil to Make Them Self-lubricating*

### *Properties of Powdered-Metal Gears*

In a comparison between powdered-metal gears and those made from cast iron for the purpose mentioned, the following facts stand out: Sixty-four per cent of the material in the cast-iron blank is removed in the machining process. Furthermore, tests show that the surface of a machined cast-iron gear is not as smooth as is that of a sintered powdered-metal gear. The smooth surface of the latter insures quietness of operation. Noiselessness of sintered iron gears is further insured by the oil cushion formed by the oil-filled pores at the surface. Because of the porosity of the sintered gear, it weighs 20 per cent less than if it had been cast.

The mechanical properties of the sintered gear are similar to

those of ordinary cast iron. This is adequate since the gears are not heavily loaded and the service is not severe, the most important considerations being accuracy of tooth shape and smoothness of surface. If it were desired to have mechanical properties of higher values, such properties could be obtained by a heat-treatment or hardening process. Hence, the manufacture of this oil-pump gear by powder metallurgy has resulted in a better gear at a lower cost.

Sample gears have been made from iron powder experimentally with a tensile strength as high as 100,000 pounds per square inch; but to do this it is necessary to use much higher pressures than are ordinarily used for briquetting operations. The sintering also takes a longer time and a higher temperature is required. The powder must be carefully controlled, and the tool wear is likely to be very great.

*The Final Inspection Line, where the Powdered-metal Parts Pass a Rigid Test before Shipment*

Consequently, as most gears are designed for resistance to wear, rather than for strength or ability to withstand shock loads, gears made from powdered iron are frequently furnished with a tensile strength as low as 25,000 pounds per square inch; but the wear resistance of such gears is generally very good. There is also less wear and tear on the tools, and short-cuts in the heat-treatment are possible; thus, the cost can be reduced sufficiently to make production in quantity practicable. Gears have been made with a tensile strength of 18,000 pounds per square inch that have proved perfectly satisfactory for their purpose. There is no need for providing higher strength than that which is necessary for the safe functioning of the gear.

Then, again, for some purposes this low-strength value would not be satisfactory and tensile strengths of from 45,000 to 50,000 pounds per square inch may be required. This is not only possible but practicable, but it should be noted that such high strengths can only be obtained at an increased cost. The tool costs increase because the tools wear out more quickly, larger presses are required for the higher pressures necessary in molding the gears, but a product is obtained that meets the requirements. One application, for example, for such high-strength gears would be the drive-gear for a washing machine rack bar. For such applications, there is available in powdered-iron metallurgy a wide field of alloys and heat-treatments, making it possible to commercially produce gears having much higher wear resistance, strength, and impact resistance than casehardened, low-carbon steel gears.

It is possible to hold dimensions of gears to small tolerances on the diameter—as small, in fact, as 0.001 inch. But it is not possible to work to such a close limit on the axial dimensions, mainly because all the variables are largely reflected in the length of the briquette. A final finishing operation is, therefore, often necessary in order to obtain the required tolerance on length dimensions.

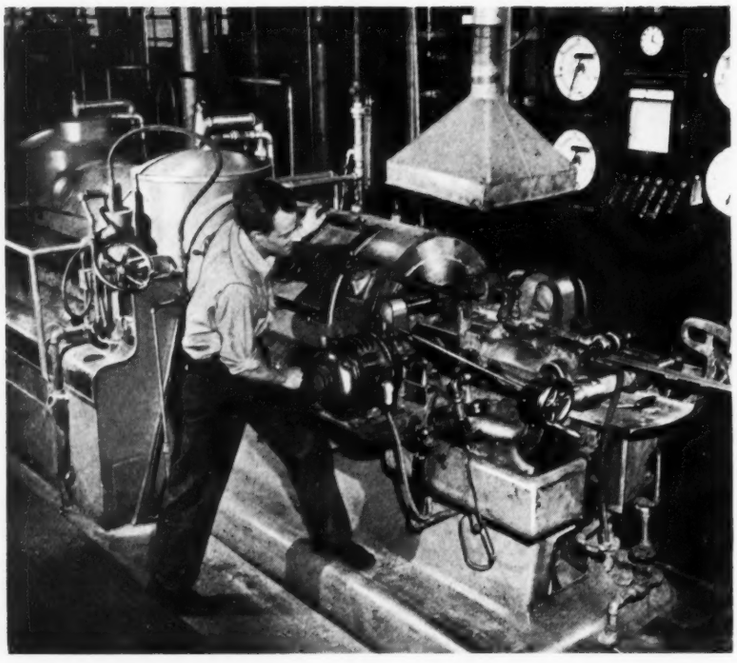
### *Limitations of the Powdered-Metal Process*

In an article, published some time ago, by Earl S. Patch of the Moraine Products Division of the General Motors Corporation on the "Limitations of Powder Metallurgy," Mr. Patch mentions a few basic factors which must be considered when designing a product to be made by the powdered-metal process:

1. The material does not flow freely, and, as a result, pieces having re-entrant angles cannot be formed. This is fundamental in the processing, and is made more important by the fact that it is necessary to compress the powder to anywhere from one-half to one-third of its original powder volume. This means that where re-entrant angles are formed at any point along the axis, it is necessary to make these parts by conventional methods of machining.

2. Length tolerances must be somewhat more liberal than those necessary with conventional methods of finishing, if extra machining costs are to be avoided. Each design must, of course, be considered individually; but, in general, a length tolerance of less than plus or minus 0.005 inch is likely to result in machining and unnecessary costs.

3. Concentricity must be considered carefully,



*An Ingenious Machine that Continuously Forces Babbitt into the Porous Powdered-metal Matrix of the Bearing, after Exhausting the Air by Vacuum*

and a reasonable limit on eccentricity provided. This is necessary because the powder is formed largely with tools which have radial fits within one another, and clearance must be provided. In some cases, these fitted pieces are likely to produce errors all in one direction, resulting in a build-up which may show as much eccentricity as 0.003 inch. This eccentricity can be corrected by a compression operation—swaging, rolling, or something of the kind; but here, again, additional handling is necessary at additional cost.

4. The design of the part must be such as would normally require a considerable cost for machining, as compared to the cost of the material. If the weight of the machined piece is about 50 per cent of the rough blank weight, whether the blank be of gray iron or steel, it is usually feasible to make it economically from powdered metal.

5. A reasonable number of parts must be required. This, like every other factor, is largely related to the design of the piece. Generally, the more complicated the machining of the piece by conventional methods, the smaller the annual quantity necessary to carry the expense for tools and equipment for powdered-metal parts. The greater the number of parts to be made, the greater the savings. A flanged bronze bushing is made at the rate of 10,000,000 a year, at a cost that is insignificantly higher than the cost of similar pieces made from flat strip stock. This, however, is only accomplished by the initial spending of perhaps $40,000 or $50,000 for special equipment and tools to make the piece; but with this expenditure once made, the operation is set for, perhaps, ten years.

On the other hand, there are some pieces which represent the other extreme, where a tool expense of $1000 is warranted on lots of 10,000 pieces, or less, per year. This is largely due to the fact that it may be possible to avoid very expensive machining. Incidentally, expensive machining in these days of high wages and high factory expense is something to be considered carefully. In some plants it costs, in labor and burden, about a nickel a minute to perform a machining operation.

There has been a great deal of misunderstanding in the industrial fields served by powder metallurgy as to the results that can be accomplished. It has been most difficult to attempt to draw the line between the parts which can be made successfully in the powdered metal laboratory and those which can be produced economically in the factory.

Obviously, new developments in methods and equipment will be needed to bring this new process to its full development. Powders of different metals will be made more cheaply; new equipment, including both presses and furnaces, will be developed; experiments are being made with continuous automatic equipment—equipment that will perform practically all operations in making powdered-metal products, including pressing, heating, and possibly additional sizing operations. High-frequency heating equipment appears to offer definite possibilities for achieving improved results in heat-treatment of powdered-metal products. Hot-pressing will doubtless enlarge the scope of the new process.

Briefly, powder metallurgy has made possible the production of many machine parts and metal products at lower cost than was possible by former methods. In some instances, it has made possible the production of parts that could not have been made in any other way.

There is still a great deal to be learned about the possibilities of powder metallurgy. Research is constantly being carried on. Manufacturing experience is being accumulated, and ultimately the process of powder metallurgy is likely to occupy as important a place in industry as many of the other processes for forming and manufacturing metal parts that have been developed to a high degree of perfection in the past.

# Maintenance and Conservation of Electric and Pneumatic Portable Tools

A COMPREHENSIVE maintenance and conservation plan has been worked out by the Rotor Tool Co., Cleveland, Ohio, pertaining to electric and air portable tools. The plan consists of four distinct parts as follows:

1. A poster is used, the object of which is to attract the attention of those concerned and to emphasize the importance of the subject. This poster contains a great deal of worthwhile information, most of which applies to all makes of electric and pneumatic tools.

2. A booklet, designed to be put into the hands of the maintenance man, covers the broad aspects referred to in the poster and gives complete instructions relating to such subjects as repairing blades, bearings, etc. The booklet is entitled "Keep 'Em Running."

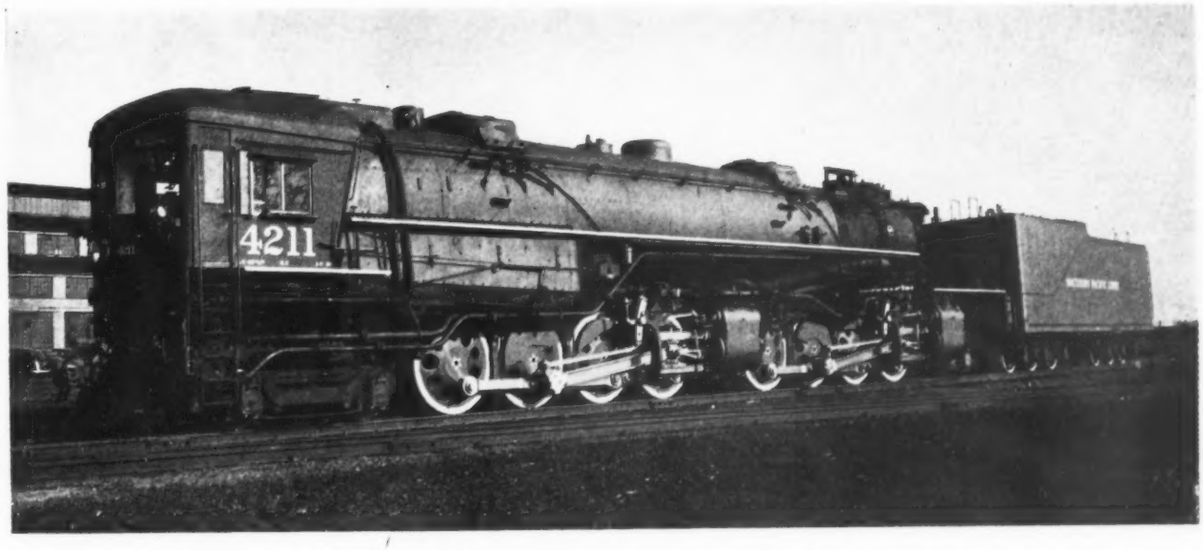
3. A service engineer of the Rotor Tool Co.—a factory-trained man who knows his business—brings this booklet and poster to the maintenance man, answers his questions, and aids him in overcoming any of his difficulties. The direct contact of the service engineer is considered of vital importance in working out this maintenance plan.

4. Detailed repair-parts sheets, such as furnished by all portable tool manufacturers, are then placed in the hands of the maintenance man, thoroughly equipping him to do his job. If the service engineer finds that the maintenance man lacks proper equipment, such as a tachometer, for example, he brings this to the attention of the management. When the engineer leaves, the maintenance man has acquired a new conception about the importance of the work he is doing, knows how to do it, and is equipped to do it.

Proper maintenance and conservation of equipment and materials is a most important part of the war effort—in some ways quite as important as the actual manufacturing operations, because these cannot be performed without properly maintained equipment.

* * *

The Division of Trade Standards of the National Bureau of Standards, Washington, D. C., has addressed a letter with accompanying data to the producers, distributors, and users of threaded parts, relating to a Recommended Commercial Standard covering screw threads and tap drill sizes. Information can be obtained from the Division of Trade Standards.




A Giant Locomotive Built by the Baldwin Locomotive Works for the Southern Pacific Lines. Forty of These Heavy-duty Oil-burning Freight and Passenger Steam Locomotives have been Ordered. The Engine Cabs Are in the Front for Greater Visibility. The Locomotive is of Class 4-8-8-2, with Four Cylinders and a Tractive Force of 124,300 Pounds. The Engine and Tender Weigh Approximately 500 Tons; the Wheelbase is 112 Feet

# Engineering News Flashes

## Unusual Lubricant Found Satisfactory for Broaching

In broaching a hole in a pressure pump valve, difficulty was experienced in obtaining the desired smoothness of finish. The hole was 3/16 inch in diameter and 2 1/4 inches long. Several cutting fluids were tried without much success until experiments were made by an engineer of the Colonial Broach Co., Detroit, Mich., with a solution of ordinary Lux soap flakes in water. The result was unusually satisfactory, the broached hole being very smooth; the Lux soap solution is now being used in regular production.

## Lead Alloys Developed to Replace Tin in Engine Bearings

According to Ralph Boyer, chief engineer of the Cooper-Bessemer Corporation, Mount Vernon, Ohio, new lead alloys for bearings are being tested by that corporation in Diesel engines and air compressors. Present indications are that these bearings will prove satisfactory, although it is planned to continue the testing for about a year, in order to prove conclusively that the lead alloys provide an adequate substitute. To quote Mr. Boyer: "We have been forced to turn to lead in place of tin, and now there is every indication that lead will produce better bearings than we have ever had before."

## Navy Equipment Assembled and Shipped 10,000 Miles in Six Days

General Electric officials at Schenectady have disclosed what they think may be a record for speedy delivery of vital navy equipment to the other side of the world. At 6 P.M. on a recent Thursday, an order was received at an eastern General Electric factory for equipment required by a United States warship near Australia. As many workers as could be employed efficiently worked that night and the next day and night.

Escorted by police, it was rushed to a nearby airport and flown westward, arriving in San Francisco on Sunday. On Wednesday, six days after the order had been received, a bombing plane landed the equipment at its Pacific destination, more than 10,000 miles from the factory where it originated. (Approved for publication by the Navy Censor.)

Twenty-five Tons of Steel Scrap are Fed Daily into the Jaws of This Giant Shear in the Metal Salvaging Department at the Westinghouse East Pittsburgh Works. The Scrap is Worth $3 a Ton More if Cut into Sizes that Fit Easily into the Steel Mill Furnaces, where the Scrap is Remelted. This Shear Each Day Helps to Salvage Enough Steel to Build a Medium Army Tank

A Giant Ore Bucket Capable of Scooping up 25 Tons of Iron Ore in One "Bite." Two Bites Fill a Freight Car. The Bucket, Believed to be the Largest Built to Date, Weighs 49,000 Pounds and is One of Four Made by the Blaw-Knox Co., Pittsburgh, Pa., for Use in the Middle West

## Airplane Engines Generate Useful Power during Tests

New airplane engines that during test runs used to consume great quantities of gasoline, but did no useful work, now have been harnessed to produce power and lighting for the production of more engines. The airplane engines are coupled to ordinary generators of the type long used in small Diesel-electric power plants. The Westinghouse Electric & Mfg. Co. has already supplied one large airplane-engine manufacturer with sixteen of these generators.

An aircraft engine can produce about 2000 kilowatt-hours of electric current during its test run. Generators now in use in one plant produce more than 4,000,000 kilowatt-hours each month, this current being valued at $24,000. This amount of electricity is enough to drive all the machine tools and supply the lighting in an entire factory. In less than two and one-half years, the generators will pay the cost of their installation. In this, as in many other ways, industry is now conserving power, materials, or labor that formerly it was not deemed practicable to save.

## Fiber Containers Manufactured with Same Machinery as Metal Ones

After many months of experimentation, the American Can Co. has developed a revolutionary method of making cans with fiber bodies on machines formerly used for the manufacture of metal containers. This new method, which the company will make available to the entire industry as soon as it has been thoroughly tried in continued production, is considered the most important development in the can manufacturing industry during the last ten years.

The most remarkable part of this method is that no new machinery is required. At a time when it is almost impossible to obtain new machinery and tools, this fact is especially important. Another advantage is that the manufacturer of the product for which the cans are to be used may also employ his present packaging machinery. The new method will make cans suitable for all products known in the trade as "dry"—drugs, cosmetics, spices, powders, etc.

## Broken Locomotive Frame Welded in Eight Hours

An emergency welding repair on a locomotive of the Rutland Railroad allowed it to be again placed in service in a fraction of the time required for replacement of parts. The locomotive frame broke under the cylinder saddle, where, due to the nature of the break, it was impossible to secure expansion or make a vee on both sides of the crack.

The welding procedure was as follows: The crack was cut out with an acetylene torch. After scarfing, the sides of the vee were chipped free of all oxide and scale. Using a Westinghouse Flexarc 400-ampere welder, a weld was started on the bottom side and built up. As the weld increased in width, beads were laid with a one-inch oscillating motion. Each layer was thoroughly cleaned with an air hammer and peened. The job was completed by one operator in eight hours, using fifty-two pounds of 1/4-inch welding rod.

# EDITORIAL COMMENT

In our war effort, ships constitute one of the most important—if not the most important—item. No matter what we produce in the way of armaments, no matter how many millions of men are trained to be efficient soldiers, if we do not have ships to carry the men and the armaments to the places where they are most needed, all our preparations will be of no avail. We need ships and more ships. It is reasonable to assume that we will ultimately crush the submarine menace, but at present the ship construction of the Allied Nations leaves no margin over the merchant marine losses.

## We Must Build Ships and More Ships to Win the War

You cannot talk ships into being, you cannot build them by printing bonds or voting huge appropriations, nor create them by the most elaborate planning. Work, and work only, efficiently directed, will produce ships. To this end, there must be cooperation between management, labor, and Government. The planning and direction of management, the work of labor, and the cooperative attitude of Government will help to speed ship construction.

Whoever does anything to slow up the production of shipbuilding jeopardizes the entire war program. No excuse is valid for the stoppage of work in shipyards. Management and labor, alike, must recognize this.

Two bills that would practically destroy the rights now enjoyed by those who have acquired patents on their inventions have been introduced in Congress (Senate Bills S2303 and S2491). They are presented to Congress with the argument that because certain great corporations have been built up on patents and have, to a certain extent, become monopolies, patents and the patent system are the cause of this condition. The first bill, if it becomes law, will give the Government, in wartime, additional broad powers over patents. It permits the Government to seize any patent upon mere notice, the owner's only recourse being a suit in the Court of Claims. No provision is made for the return of the patent to the owner when the war is over, or for limiting the term of any licenses which may have been granted. Furthermore, after seizure, the owner may not even operate under his own patent. This bill also permits the Government to grant licenses as it chooses and says that the President shall prescribe a reasonable royalty, but makes no provision for its payment either by the Government or the licensee.

## Inventors' Present Rights Taken Away by Proposed Bills

While the bill allows the patentee recourse to the courts, it prohibits the courts from awarding more than the amount prescribed by the President. This means not only that a man's patent can be taken away by executive order, but that the inventor's remuneration will be fixed by some Washington officeholder and that the courts cannot disturb his decision.

## Owner May Lose Right to Operate Own Patent

The Boston Patent Law Association, 350 Tremont Bldg., Boston, Mass., says of this bill that our American system of law revolts at such undemocratic procedure, even if the Constitution would uphold it. This Association has published a very concise and to-the-point statement relating to this patent legislation, from which some of the foregoing has been quoted.

The second bill, in peacetime, will bring about three fundamental changes in the patent system: (1) After a patent has been in force three years, the Commissioner of Patents may grant a license under any patent that is not being manufactured or for which licenses have not been granted. (2) No license may be granted that limits the quantity of goods produced under the patent, the price at which they are sold, the use to which they are put, and the region in which they are to be sold. This provision is retroactive and applies to all existing licenses. (3) No patentee may sue the seller or user of a patented article unless he has first sued the infringing manufacturer successfully.

# Are Union Leaders Using the War to Gain Their Own Ends?

THE following letter, addressed by Edward L. Ryerson, chairman, and W. Sykes, president, of the Inland Steel Co., Chicago, Ill., to the stockholders of the company, speaks for itself. It is quoted here because men engaged in industry everywhere should know what is being done by our Government and by labor leaders during the present national emergency.

"To the Stockholders of
Inland Steel Company:

"The Inland Steel Company has had to accept the order of the National War Labor Board on what is called 'union security.' Inland will sign a contract with the Steelworkers Union providing for the 'check-off' of union dues and the discharge of any member who does not keep himself in good standing with the Union.

"But Inland does this under duress. In the name of patriotism, Inland is compelled to do a thing which it believes to be wrong, because the alternative would interfere with war production.

"The Steelworkers Union has deliberately chosen the period of the war to seek from the Government special privileges which it has never been able to obtain by its own efforts.

"Meanwhile, the preoccupation of the public with the grim task of winning the war has blacked out the normal sense of injustice which would have swept across the nation had the issue been fully understood.

"The American public does not realize the extent to which the Steelworkers Union has employed physical violence in getting and keeping members. It does not realize that large numbers of men have joined and remained in the Steelworkers Union through fear, and fear alone. And now, by the order of the National War Labor Board, those men must continue to be members of the Union and must go on paying dues whether they wish to or not. No matter what policies the Union leaders evolve, the members of the Union must support those leaders indefinitely. Their normal right to protest by withdrawal has been taken away.

"Theoretically, each worker is given a chance to resign during fifteen days. But how is he to know what his rights are, and who is to tell him how to resign; and, if he joined through fear and has stayed in through fear, who is to assure him that it is now safe to resign?

"The Company itself was allowed only ten days within which to reach a decision. In that time it could not even consult with its stockholders.

"And facing the Company during this ten-day period were two direct threats. The Steelworkers threatened to strike if the Company did not comply. The War Labor Board threatened to invoke the full war power of the President to compel the Company to comply, meaning that the Company's plants would be taken from it. The Company had no alternative. It had to comply.

"Seldom in the history of democratic institutions has there been such an arbitrary exercise of power by a Government agency. Inland's record of devotion to the nation's cause is unquestioned. And now it is compelled, by threat of confiscation, to forego a right never heretofore denied, a day in court.

"But no private wrong, however shocking to the individual's sense of justice, can stand in the way of the war effort. A steel plant is a war facility, and not one ton of production can be lost.

"Utterly wrong though it believed the War Labor Board's order to be, Inland had to comply."

Edward L. Ryerson, Chairman — W. Sykes, President

* * *

## Substitute for Copper, Brass, and Aluminum Tubing

A soft, annealed steel tubing with fused copper coating inside and outside is finding an increasing number of applications now that the sale of copper, brass, and aluminum tubing is restricted. This steel tubing has been used for a number of years in automobiles for gas lines, oil lines, hydraulic brake lines; in oil burners, gas ranges, and stoves; in electric refrigerators; in unit heater piping; and in lubrication and hydraulic lines for machine tools. This tubing, known as Bundyflex metal tubing, is manufactured by the Everhot Products Co., 2055-59 W. Carroll Ave., Chicago, Ill.

The tubing, being of steel, has high fatigue resistance and mechanical strength. It is relatively soft and ductile, however, and can be readily bent and flared. Sizes ranging from 1/8 to 3/8 inch in diameter are available, and any of the fittings ordinarily employed with copper tubing, including sweat fittings used in refrigeration and plumbing work, can be utilized with this steel tubing. It comes in 25- and 50-foot coils and 12- and 20-foot straight lengths.

# Expediting Blueprint Delivery

Fig. 1. Pneumatic-tube System Utilizing 3-inch Tubes, Satisfactory for Messages, Proved Inadequate to Handle the Mass of Blueprints Required in the Douglas Plant Each Day

**When Over 30,000 Blueprints are Required at Various Points in a Mile-Long Plant, Something besides Office Boys is Needed to Get Them to the Job and Back Again. This Article Tells How the Douglas Aircraft Co. Solved the Problem**

THOUSANDS of different blueprints must be transported back and forth between the central files and the many different departments where they are utilized in one of the Douglas Aircraft Co.'s huge plants in California. Almost every minute of the twenty-four-hour operating day, blueprints are being delivered or returned through an unusual pneumatic-tube system that extends for a total distance of over 7000 feet to various key points or sub-stations around the plant. This system is unusual from the standpoint of the size of the carriers used and the length of the system. At the time of installation, there was only one other like it.

Formerly, an extensive 3-inch cylindrical-tube system, the central receiving station of which is shown in Fig. 1, provided carrier and messenger service to the production line or other source of request. The capacity of the carriers in this system was quite limited, and because of their shape they were not well adapted for carrying blueprints. When used for this purpose, the bulky print had to be rolled up in a fairly compact form for insertion into the carrier. The volume of blueprints to be transported grew to tremendous proportions—thousands are needed for a single plane design. It soon became evident that a conveyor system of considerably greater capacity was required.

Because of the speed at which a pneumatic-tube system can be operated, it was decided to employ this method exclusively for transporting blueprints, but in a form somewhat different from that hitherto developed. The new system was built around the use of large rectangular carriers into which a number of blueprints could be readily placed without additional fold-

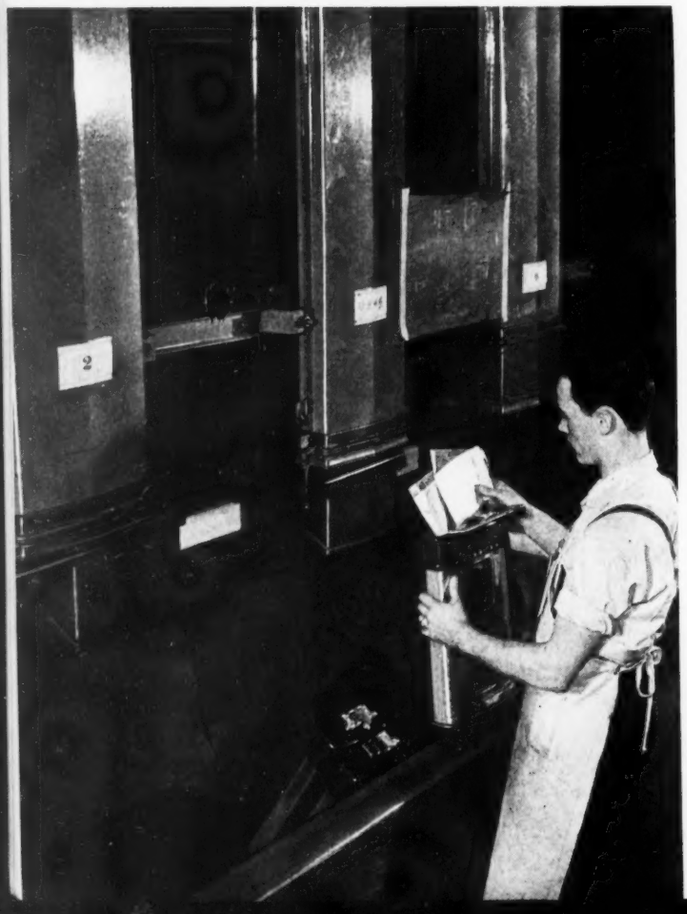



Fig. 2. Receiving Sub-station of Pneumatic-tube System. Note Large Capacity of Carriers, into which Blueprints are Inserted without Additional Folding

# in a Large Aircraft Plant

ing. These carriers are shot through sizable chutes hung from the plant ceiling, as shown in Fig. 3.

Power for the system is furnished by four Spencer turbo-compressors operated by 15-H.P. electric motors. These provide a displacement capacity of 2000 cubic feet a minute and produce a 161-ounce per square inch vacuum. Because of the size and length of the transmission tubes, power relay stations are provided at suitable intervals.

Six sub-stations, similar to that shown in Fig. 2, are located at convenient points throughout the plant for the receipt and distribution of the blueprints. The ample capacity of the carriers, which have an opening 12 inches long by 3 inches wide, is clearly evident in this illustration.

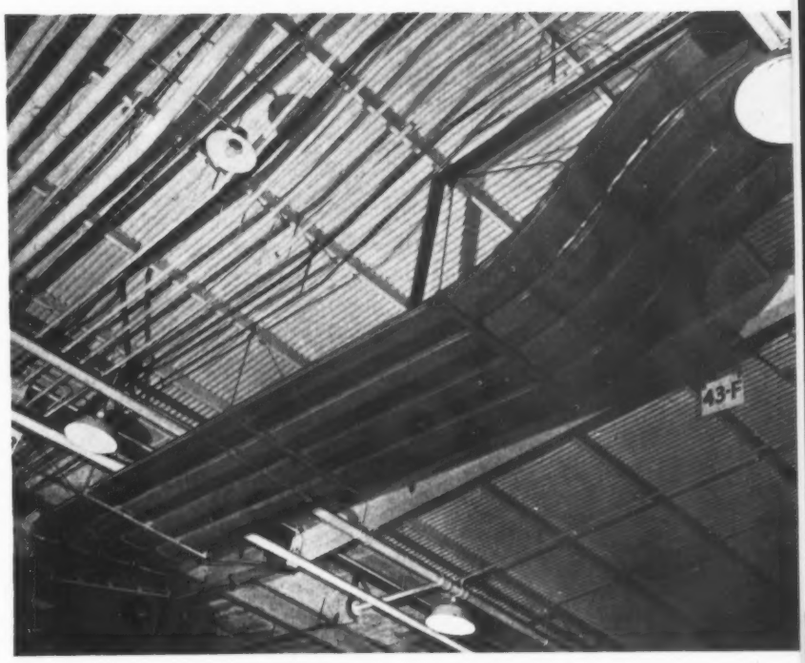


Fig. 3. Large Rectangular Chutes of New Blueprint Delivery System are Suspended from Plant Ceiling. Over 7000 Feet of This Conveyor System Extend throughout the Plant

The new system of blueprint delivery has not only speeded up the transporting of drawings, but, in conjunction with a centralized blueprint control office, has curtailed the production of blueprints by at least 40 per cent. Before the new delivery system was installed, it was common practice to distribute copies of prints to at least five key departments, and, in some cases, up to fifteen. Now, only two prints are necessary—one on call and one in reserve. Thus, shop orders for a specific part no longer require a copy of each blueprint for the manufacturing, inspection, sub-assembly, and installation departments.

As shown in Fig. 4, when the prints are no longer needed, they are placed in a shredding machine which quickly transforms them into uniform, easily baled, and unreadable scrap.

* * *

In spite of the idea of many well meaning but uninformed people that men over forty are not wanted in industry, long service records with the same company are not unusual in our industries. The Standard Oil Co. of Indiana has awarded gold pins to nearly 12,000 employes who have been in its service ten years or more. Of these, 95 have to their credit forty or more years; 607 have worked for the company for thirty years; and over 4000 for twenty years.

Fig. 4. Shredding Machine for Disposing of Obsolete and Worn-out Blueprints. Uniform, Easily Baled, and Entirely Unreadable Scrap is Produced

# Instructing New Supervisors in Plants Converted to War Work

By ALFRED M. COOPER

ONE of the most difficult problems arising from the sudden expansion of our industries from depression level to wartime level is that of finding enough men who can be developed quickly into adequate shop supervisors. Almost certainly, these new supervisors will be selected from among the relatively small working forces maintained during the last ten years. In most cases, those chosen will be men who have had no previous experience in handling subordinates, and whose whole outlook is that of the workman rather than that of the supervisor. Management is well aware that unsatisfactory supervision can make plenty of trouble in any organization. The present situation multiplies the possibility of such trouble.

In normal times, when the rate of plant expansion is controlled only by economic factors, it is possible to put these new supervisors through some sort of foremanship or supervisory course of training shortly after their selection for a supervisory job. Such a procedure is not practicable now, since the usual foremanship training conference has for its basis discussions of the experience of the group members in handling men, and most of the new supervisors have had no experience in this field.

If foremanship training conferences are being held with the old supervisors, it is possible to induct a certain number of "green" supervisors into these groups, where they can learn a great deal just by listening to the discussions of supervisory problems carried on among the experienced foremen. However, where no such supervisory training is in effect, there are a number of things that can be done to assist the new supervisor in acquainting himself with his job.

### *Responsibility of Job Must be Emphasized*

As soon as a group of new supervisors has been selected from the ranks of the working force, these men should be called together in an auditorium or conference room and given a talk by someone in authority, preferably the general manager or works manager. Among other points, this executive should emphasize, first, the responsibility that has been placed upon these men, and, second, the fact that they are now beginning their apprenticeship at an entirely new trade—supervision—and that, while their expert job-knowledge will be valuable to them, their real worth to the company from now on will depend upon how quickly they can master the art of handling men. Such a talk will help these men to pass more quickly through that stage where they continue to think in terms of production with their own hands rather than with their brains and the hands of other men.

In this talk, it should be possible for the executive to recommend to the new supervisors one or more good books on supervision; these may be obtained from public or plant libraries. Such reading will help to give the men a better understanding of the ramifications of their new jobs. Stress also should be placed upon the necessity for the new supervisor to consult at once with his superior when in doubt as to the proper course of action to pursue; and to do this, if possible, before taking any action at all.

### *Advice of Older, Experienced Supervisors will Prove Helpful*

The next step in helping to orient the newly appointed group of supervisors should be taken in a similar meeting attended by the older supervisors of the company. In this meeting, the executive should emphasize the need for close supervision of the activities of the new supervisors and for the exercise of patience in bearing with their early mistakes, as well as the importance of making every effort to foresee the situations from which such errors may arise and obviate these in advance. Such an appeal to the experience, knowledge, and cooperative instinct of these older supervisors will go a long way toward eliminating friction and the costly errors which otherwise would inevitably occur when so many green supervisors are directing the efforts of equally green workmen. These matters can be taken care of much more effectively in meetings than by memoranda.

Supervisory training by the lecture method has not proved successful when the training group is made up of experienced foremen or department heads. Under the present abnormal conditions, however, it may be found advisable to follow up the works manager's talk to the new supervisors with a series of lectures on the

technique of supervision. As the new supervisors realize their ignorance of this subject, there should be none of the resentment encountered when you attempt to tell a seasoned supervisor how to handle men. Any personnel man who is familiar with foremanship training should be qualified to deliver these lectures.

Finally, an appeal by the general foremen and superintendents should be made directly to those foremen and straw bosses who are of equal rank with the newly appointed supervisors, yet who have had some years of experience in handling men. Frequently, the green supervisor would prefer to go to a man of equal rank for advice than to his boss. When this happens, the brother supervisor should be prepared to go out of his way to help the new man. This he may not do if he does not understand his responsibility in respect to cooperation in the existing emergency.

The suggestions offered here require little time and effort to be put into effect. Any or all of them may be applied. Impaired employe morale, injuries to workers, spoilage of material—these are but a few of the things that may be avoided or reduced by giving this new supervisory force a chance to understand its job.

## Empty Gas Cylinders Should be Put to Work

The production requirements today have placed increased demands on the oxygen and acetylene industry. This demand can be met if empty cylinders are returned promptly and if cylinder stocks in the hands of users of oxy-acetylene welding and cutting equipment are maintained at a minimum. The Linde Air Products Co., 30 E. 42nd St., New York City, gives the following rules, which, if observed by industry, would greatly facilitate the war effort:

Keep cylinders moving; they must not be permitted to stand idle, either full or empty. The cylinder supply is still deemed adequate to keep oxygen gases and acetylene gases continually and readily available, if users will cooperate in speeding up the return of cylinders.

Refrain from ordering more oxygen or acetylene than is required for immediate needs. Most shops allot no more than three oxygen and three acetylene cylinders to every two welding and cutting outfits in active service. This plan permits ample reserve.

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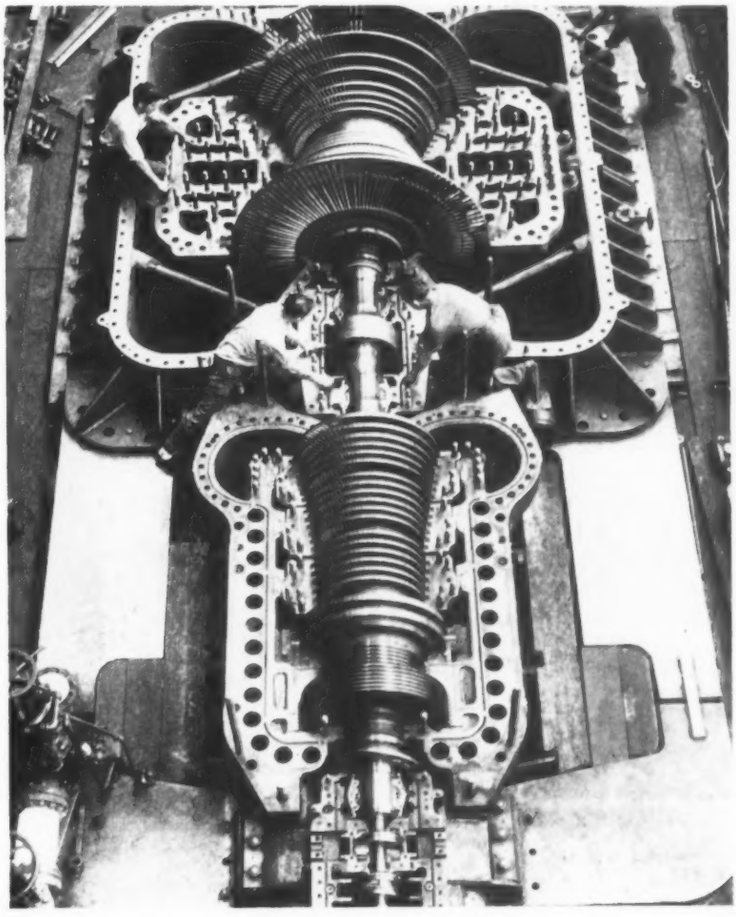


*A Final Check-up of Thousands of Precision-finished Stainless-steel Blades for a 50,000-kilowatt Steam Turbine, Built by the Westinghouse South Philadelphia Works for the Toledo Edison Co.'s Acme Generating Station in Toledo. The Tip Speeds will Run as High as 850 Miles an Hour*

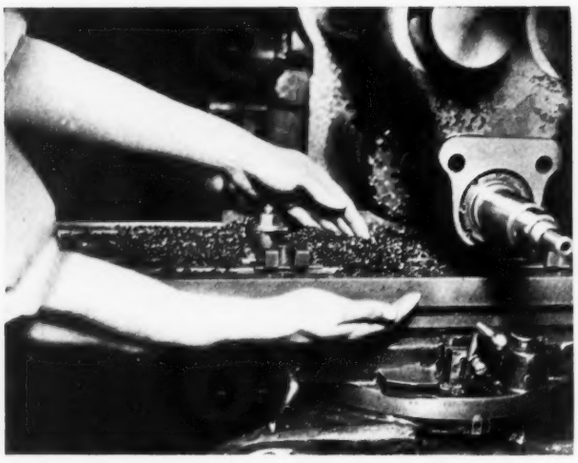


Fig. 1. Wrong Way of Cleaning Chips from a Milling Machine. Serious Infections May Result

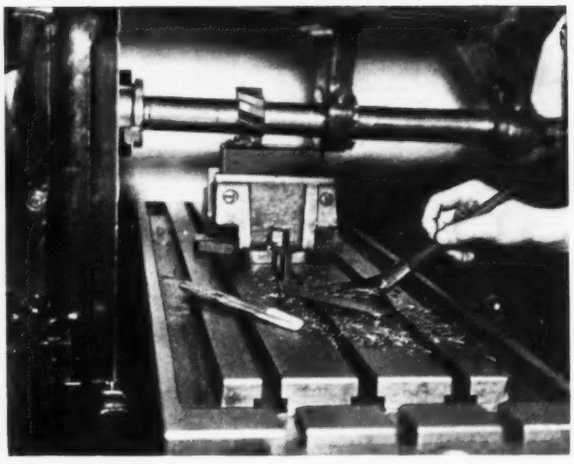


Fig. 2. Clean Chips from the Table with a Brush, Wooden Stick, or Metal T-slot Cleaner

# Effective Way of Instructing Machine Shop Operators

By W. L. BOND
General Electric Co., Schenectady, N. Y.

ONE of the difficult and highly important management problems at the present time is the rapid instruction of machine operators, so that unskilled or comparatively unskilled men may quickly be able to take their places in the production lines. Short-term courses, in which men are trained for several weeks to do one specific job, have been conducted for some time at General Electric plants. To supplement these courses and to assist the new operator in avoiding mistakes that have been made by others, the plant management furnishes him with instruction booklets covering important points.

One of these booklets, especially prepared by the company, covers some of the mistakes most commonly made by new operators on milling machines. It is entitled "Suggestions to Milling Machine Operators." In this booklet, the subject of safety is particularly stressed: "Your

Fig. 3. Milling Cutters should Never be Stored so that the Cutting Edges will be Nicked

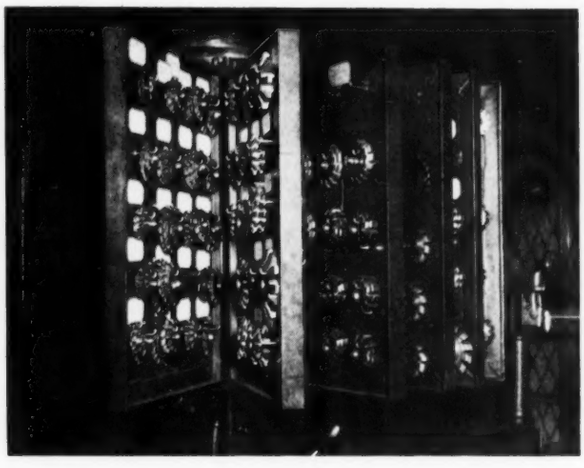


Fig. 4. If Milling Cutters are Stored in This Way, the Cutting Edges will Not be Injured

first consideration in the shop should be safety —safety to yourself, to your fellow workmen, and to the equipment entrusted to your care." Actual figures are included of the cost of milling machines, so as to give the new man an idea of the value of the equipment that he is handling and the seriousness of any damage to it. Then follows an illustration of a typical milling machine with a list of names of the main operating parts.

The remainder of the booklet is made up chiefly of showing the wrong and right way of doing various things. For example, the wrong way of cleaning chips from the machine contrasted on the opposite page with the right way. Brief text and clear illustrations make it possible for the inexperienced operator to quickly grasp the idea presented. Other examples are the wrong and right way of removing an arbor, the wrong and right way of storing cutters and arbors, etc.

Orderliness is emphasized by showing that when machines are cluttered up with tools and parts injury to the ways of the machine may result. The importance of lubrication is duly emphasized, as well as the use of clamps and wrenches, methods of clamping work, and general care of the machine. The accompanying illustrations indicate how the wrong and the right way are shown in the booklet.

Fig. 1 shows the wrong way of cleaning off chips from a milling machine table. Under this illustration in the General Electric publication is this caption: "The hands or fingers should never be used to clean chips from the machine. Chips made by a milling cutter tend to be especially sharp, and sometimes so fine that they are hardly visible. Such chips penetrate the skin and flesh very readily and may be the source of a serious infection if not cared for promptly and properly." Fig. 2 shows the right way, the chips being cleaned from the machine with a brush, wooden stick, or metal T-slot cleaner.

Fig. 3 shows the wrong way to store milling cutters and is accompanied with this caption: "Milling cutters should not be stored so that the cutting edges will be nicked. Each nick will show up in the work the next time the cutter is used, unless it is ground out. This should be avoided as it shortens the life of the cutter. It should be necessary to grind a cutter only when it is dulled through normal use. When the job is completed, the cutter should be returned immediately to the tool-crib, where it can be properly stored."

Fig. 4 shows the right way, with the following explanation: "Milling cutters should be stored so that the cutting edges will not be nicked. They should be handled and stored as carefully as razor blades, to avoid injury both to the hands and to the cutting edges. A milling cutter is a precision instrument and should be

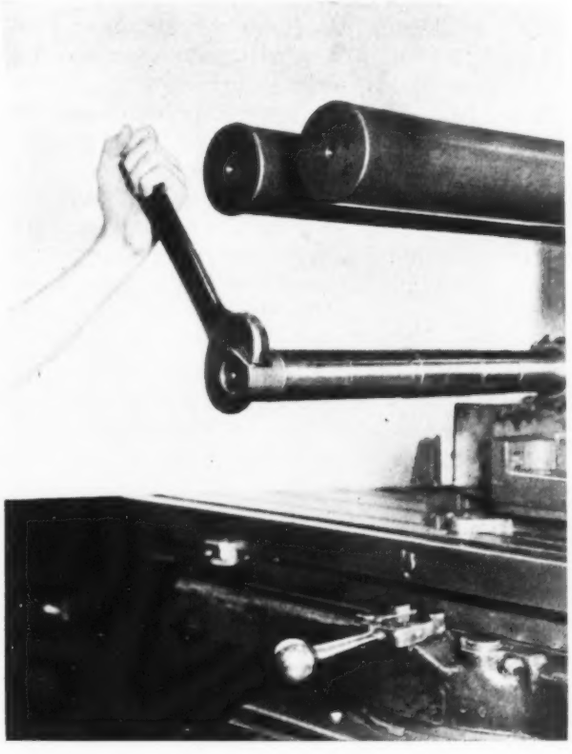


Fig. 5. A Wrench Applied to an Arbor Nut without the Arbor Yoke in Place will Bend the Arbor

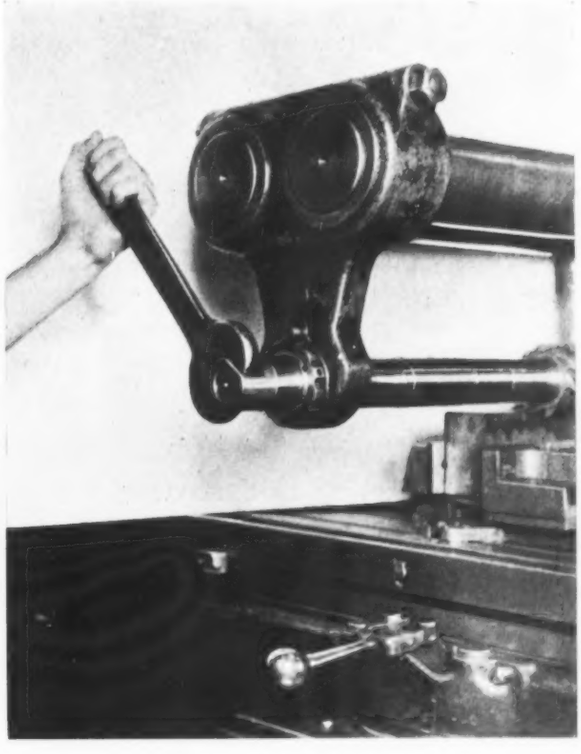


Fig. 6. The Arbor Yoke Should be in Place Whenever a Wrench is Used to Tighten or Loosen Nut

handled accordingly. An ordinary standard cutter costs about $12. A special cutter may cost up to $80."

Figs. 5 and 6 show the wrong and right way, respectively, of unscrewing an arbor nut. The wrong way, illustrated in Fig. 5, is accompanied with this statement: "A wrench used on the arbor nut when the arbor yoke is not in place will bend the arbor and make it unfit for accurate and efficient work. A milling machine arbor costs from $35 to $115, depending upon its size and type. More arbors have been spoiled through the lack of proper support than from any other cause."

The right way, in Fig. 6, is accompanied with this explanation: "The arbor yoke should be in place whenever a wrench is used to tighten or loosen the arbor nut. This will prevent injury to the arbor. A bent arbor will cause the cutter to wabble and not run true. This, in turn, will not allow each cutting edge to remove an equal size chip. Some edges will remove more than others, which will prevent efficient operation of the machine and tend to spoil both the cutter and the work."

* * *

## Fostoria Pressed Steel Corporation's Twenty-Fifth Anniversary

The Fostoria Pressed Steel Corporation, Fostoria, Ohio, was organized during the first World War, in 1917. To commemorate its twenty-fifth anniversary, the company has brought out an attractive publication entitled "Production Weapons for War Industries," in which the applications of the products of the company in industry are featured mainly through illustrative material. The subjects covered are: Balanced Lighting—Maximum Seeing Efficiency on Each Worker's Job; Near Infra-Red Process—Faster and Better Baking, Drying, Preheating, and Dehydrating; Localized Filtering—Faster, Finer Finish in Precision Grinding. Part of the publication is devoted to the men behind the Fostoria products in manufacture and in sales.

* * *

## Annual Meeting of the American Welding Society

The twenty-third annual meeting of the American Welding Society will be held at Hotel Cleveland, Cleveland, Ohio, during the week of October 12. Technical sessions will be held in the forenoon and afternoon Monday, Tuesday, and Wednesday, as well as Thursday forenoon. A comprehensive program has been prepared, including about sixty papers on almost every phase of the welding and cutting of metals.

## Fiberglas Replaces Many Scarce Materials

As a new basic material made of ingredients plentiful in the United States, Fiberglas—glass in pliable fiber form—is assuming rapidly increasing importance in replacing scarce materials such as cork, aluminum, asbestos, and mica in numerous applications. Fiberglas-insulated cables, for instance, can be used without metal conduits in airplanes. Here Fiberglas helps to save weight, as well as saving important material. It is also taking the place of cork in certain types of low-temperature insulation. Cork is normally imported in large quantities from Spain, Portugal, and North Africa, and the available supplies have been greatly reduced by the war conditions.

The shipping shortage and the menace of submarine warfare have also affected supplies of mica from India and of non-ferrous asbestos from Africa. In the manufacture of insulation for electrical equipment, Fiberglas is being combined with mica, thus reducing the amount of mica required.

Fiberglas electrical insulation is replacing asbestos in certain types of electric motors, generators, and transformers. Electric tapes woven from glass fibers have greater tensile strength than similar types made of either cotton or asbestos. This strength is retained by Fiberglas tapes through a temperature range rising well above the temperature at which other tapes are destroyed. Fiberglas tapes are stronger at 800 degrees F. than either cotton or asbestos tapes at ordinary room temperature.

It is stated that the light weight of Fiberglas products, compared with other products used for the same purpose, is often of great advantage. In the construction of battleships, for example, every pound of dead weight saved adds to the fighting power or cruising range. The use of Fiberglas thermal and electrical insulation in a modern battleship is said to make possible a saving of approximately 60 tons. This saving is equivalent to the weight of munitions required to fire four to five salvos from the main battery or to the weight of enough fuel oil to give the vessel six additional days away from its base.

* * *

## Increased Railroad Freight Traffic

Due to heavier loading and longer hauls, the railroads, in the first four months of 1942, transported nearly 40 per cent more freight, measured by ton-miles, than in the same period in 1941, although the number of cars loaded with revenue freight increased only 11 per cent.

# Marked Economy of Welded Construction in Production of Machine Bases

By R. A. GAST, Mechanical Engineer
The Lincoln Electric Co., Cleveland, Ohio

ARC-WELDED steel construction has proved very economical when applied to the production of groups of bases which are almost identical in shape, varying only in the location of two units with respect to their common center line. In this case, a manufacturer of pumps and similar equipment, for example, required 270 variations of a base for his complete line.

Assuming that combination patterns could be used with a possible ratio of 5 to 1—that is, five bases could be made from one combination of patterns—it would be necessary to have fifty-four patterns to take care of all sizes. With an average cost of $250 per pattern, the investment in patterns would be $13,500. The charge for depreciation and storage on these patterns would be at least 10 per cent, or $1350, an amount sufficient to purchase complete arc-welding equipment.

A typical example of such a base, as produced by the casting method, is shown in Fig. 1. The two units comprising this base are 22 by 14 inches and 18 by 18 inches, and have an over-all depth of 4 1/4 inches. This cast-iron base weighs 275 pounds. The cost, without machining, estimated at 6 cents per pound, is $16.50.

The appearance of the cast-iron base can be compared with that of the arc-welded steel base by referring to Figs. 1 and 2. Units *A* and *B* of the welded base are joined or connected by a bar member *C*. The two units *A* and *B* can be placed in innumerable positions in relation to each other and welded to member *C*. Thus, by varying the length of bar *C*, all possible combinations of units *A* and *B* can be obtained to form any required base. The units can, therefore, be made up and carried in stock.

Since the base height is 4 1/4 inches, angles having a 4-inch leg should be used, with the 4-inch leg in the vertical position. Boss plates should be 1/4 inch thick to bring the base to the required height. The dimensions of boss plates *F* for unit *A* are 4 by 13 1/2 inches by 1/4 inch, and for boss plates *G* for unit *B*, 5 1/2 by 17 1/2 inches by 1/4 inch. These dimensions determine the size of the other leg of the angles required for framing the two sides of each unit. For unit *A*, the sides *D* should be 5- by 4-inch angles; for unit *B*, the sides *E* should be 6- by 4-inch angles. The boss plates *F* and *G* are welded to the 5- and 6-inch legs of angles *D* and *E*, respectively.

The web thickness of the angles is determined by the load the base is to support. If the casting has a section or web 5/8 inch thick, the greater strength and rigidity of rolled steel will permit the use of angles with webs only 3/8 inch thick. The end angles may be 4 by 4 inches by 3/8 inch. Bar *C*, the member common to both *A* and *B*, is 4 inches by 3/8 inch.

The welds are all made on the inside of the

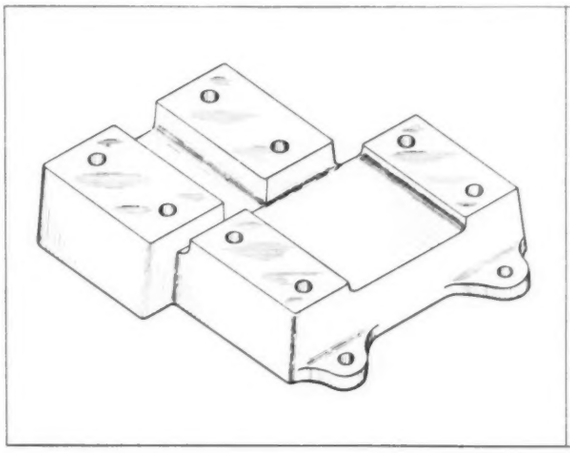


Fig. 1. One of 270 Variations of Cast Base. Total Pattern Cost for All Bases, $13,500

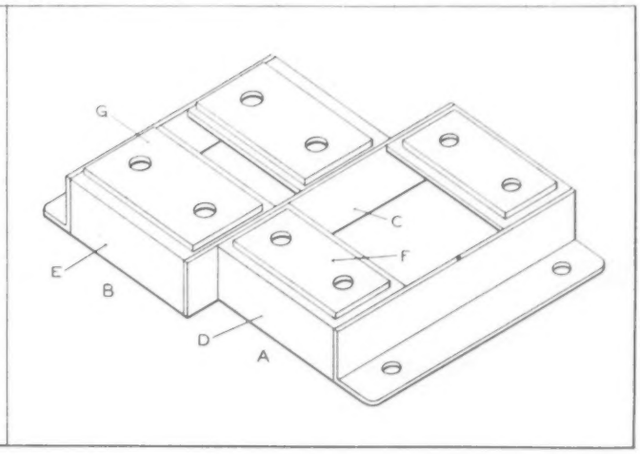



Fig. 2. Arc-welded Steel Base that Replaced Cast Base Shown in Fig. 1, at About One-half the Cost

base. This is easily accomplished by turning the base over for the welding operation. The boss plates are welded all around from the top side of the base. Welding all around the boss plates is not essential to sound construction, as a few intermittent welds properly placed will suffice. However, the appearance is improved by a continuous weld, but the cost is also increased.

The cost of the arc-welded rolled steel base is as follows:

| | |
|---|---|
| Steel, 127 pounds at 3 cents per pound | $3.81 |
| Cutting | .10 |
| Welding 6.3 feet of 3/8-inch fillet at 10 cents per foot | .63 |
| Welding 13.5 feet of 1/4-inch lap at 6 cents per foot | .81 |
| Overhead, 200 per cent of labor cost | 3.08 |
| Total cost of welded steel base | $8.43 |

It should be noted that the design of the steel base is calculated on the physical characteristics of welds made by a shielded arc.

* * *

## Maintenance of Electrical Shop Appliances and Equipment

Speaking before the Cincinnati Electrical Maintenance Engineers Association, C. W. Fick, of the General Electric Co., mentioned that the first step in preventing interruptions which may be caused by accidents to, or failures of, electrical equipment in a plant, is to keep an up-to-date list of all electrical equipment in the shop. This should record every motor, control box, transformer, circuit-breaker, and electric cable in terms of sizes, rated capacity, etc.

There should also be a regular schedule of inspection, so that the load carried by the electrical apparatus, as well as the condition of the apparatus, is constantly known. If nothing is done until failures actually occur, there will be too many failures. Production engineers are calling for increased output. If the maintenance engineer knows what that means in terms of load on his electrical apparatus, he can take steps to see that the production is not stepped up to a point where there is a failure before additional equipment has been secured.

Further, it should not be necessary for motors to squeak because of lack of oil, or smoke from overload, before their condition is checked with a view to preventing trouble. Breakdown of equipment has more than once been due to the fact that the oil level has not been maintained. Such failures are really a reflection on the care and attention given to the equipment by the maintenance man. By adopting a regular inspection schedule many failures of this and similar kinds can be prevented.

## Industrial Developments Due to the War Effort

In a recent address made by Frank W. Curtis, of the Van Norman Machine Tool Co., Springfield, Mass., and past-president of the American Society of Tool Engineers, the effect of the war on industrial developments was emphasized. "The war effort has resulted in the development of processes and products that otherwise might have been delayed," said Mr. Curtis. "After the war, it will be another problem for the tool engineer to apply these discoveries and make them available for public consumption.

"Automobiles and airplanes are two outstanding products that will derive the benefit of scientific research and thus create a vast number of changes in our way of life. Just what the automotive engineer will do after the war is still a secret, but it is safe to assume that the industry will be reborn, as will many others.

"America's increased capacity in the production of aluminum and magnesium will bring about a tremendous expansion in the use of light metals for automobile uses. These metals will, no doubt, compete with steel for many purposes. Plastic materials will be available in larger quantities than ever, and automobile bodies of plastic design are quite possible to conceive. Plastics capable of withstanding heavy blows are already available for many war uses, and will find even more uses in peacetime."

* * *

## New Uses for Molybdenum

The development of new uses for molybdenum, a neglected metal which already has lessened this country's dependence on outside sources of other steel-alloying materials, has been reported by Dr. A. A. Bates, manager of the chemical and metallurgical departments of the Westinghouse Research Laboratories.

Because nickel-steel is in great demand for shells and armor plate, molybdenum and chromium are now being used in place of nickel as the strengthening agent in steel for shafts, bolts, gears, and other highly stressed parts for such machines as motors and generators. When tungsten was added to the list of strategic materials, a substitute was needed for tungsten high-speed steel, which contains about 18 per cent of this metal. The substitute is molybdenum.

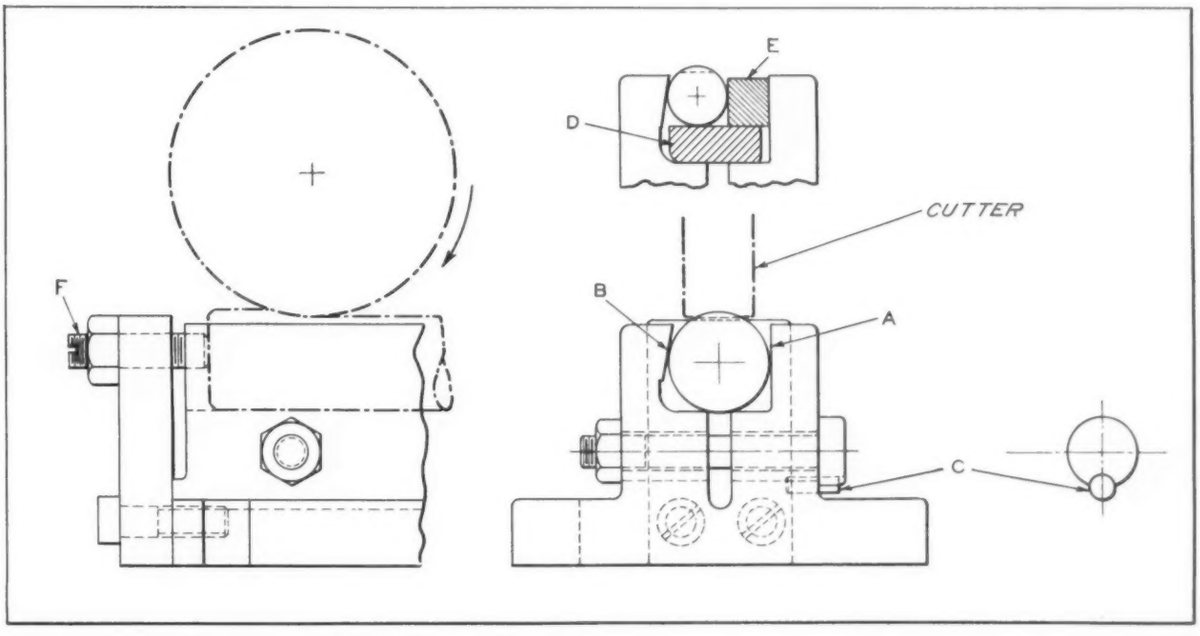
Molybdenum is a latecomer to the production line, partly because the nation's great stores of it were discovered in comparatively recent years, and partly because of the difficulties metallurgists had in learning to produce and heat-treat alloys containing molybdenum. This country now produces 90 per cent of the world's supply.


## Fixture for Holding Round Stock while Milling or Drilling

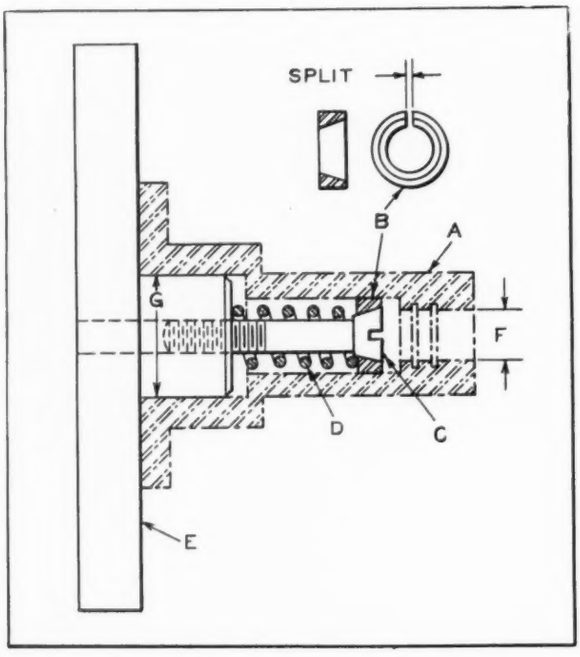
By P. VERAA, River Edge, N. J.

Occasionally, it is found impractical or impossible to use V-blocks for holding round stock with clamps located on top of the work because the clamps interfere with the cutter. A fixture designed by the writer for holding round bars or stock in cases of this kind is shown in the accompanying illustration. It consists of a semi-steel casting or base with a straight slot along the center. The work is clamped securely when the machine jaws *A* and *B* are drawn together by tightening the hexagonal nuts on suitably spaced bolts. This clamping method causes jaw *B* to exert a wedging action against the work, which clamps it securely against jaw *A* and the bottom of the slot.

The upper view shows how different sizes of stock can be clamped in the fixture by using ground spacing blocks *D* and *E* of proper thicknesses. The work is, of course, positioned and removed by sliding it lengthwise in the fixture. Stop-screw *F* is provided to prevent the work from moving endwise, and pin *C* serves to keep the clamping bolt in place. The length of the fixture is determined by the length of the bars to be machined.




Holding Fixture Designed for Use in Drilling or Milling Round Bar Stock




Fixture for Holding Piece A while Boring Small End to Diameter F

## Boring Fixture for Small Part

By DONALD A. BAKER

The fixture shown in the accompanying illustration was recently designed to handle the part shown at *A*. The major inside diameter had previously been accurately machined, but it was necessary to turn the piece around and bore the small end concentric with the machined bore.

The fixture consists of the faceplate *E* with a hub turned to a diameter *G* on which the work is a wringing fit. Into this faceplate is threaded a standard socket-head cap-screw *C*, the head of which has been changed as shown, a taper having been ground on it to fit a hardened and ground split ring *B*. A heavy coil spring *D* is located under ring *B*.

In operation, the work is slipped over the projecting part of the faceplate and the split ring. The screw *C* is then tightened until the pressure generated by the spring acting in connection with the taper on the screw-head forces the ring to expand inside the piece. The continued tightening of the screw pulls the ring ahead and thus both forces the work to seat against the faceplate and holds it against turning while boring the small end to diameter *F*.

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## Die-Shoe with Adjustable Stops

By JOSEPH SCHLINGER, Middleport, N. Y.

The die-shoe shown in Fig. 1 has been designed to facilitate quick adjustment of the work-locating stops. With this equipment, various sizes of stock can be punched without changing die-shoes and stops. A cross-section *X–X* through the die, Fig. 1, and a side view of the punch are shown in Fig. 2.

Die-shoe *A* has slots milled in it to accommodate adjustable stops *E* and *H*, also shown in Fig. 3. Supporting block *B* serves to hold the screws *C* used for adjusting stops *E*. When the stops are adjusted to the required positions, they can be locked with 1/4-inch set-screws *S* in stripper plate *G*. Adjusting screws *C* are held securely in place by means of spring rings *D*.

Stripper plate *G* has three slots milled in the under side which are approximately 1/8 inch deep. This allows the stepped ends of stops *E* to slide over the round die *F* and thus be ad-

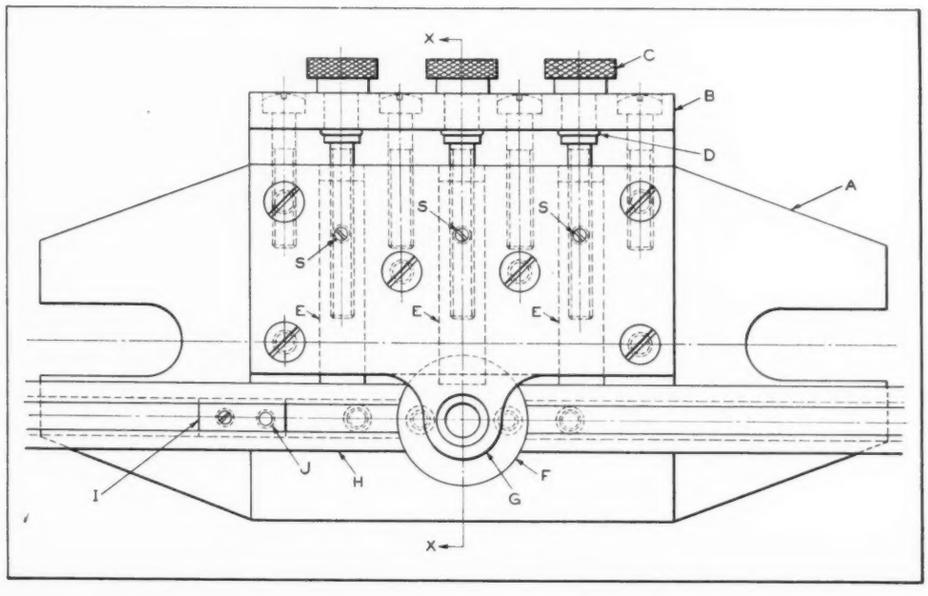



Fig. 1. Plan View of Die-shoe with Stops that can be Adjusted Quickly to Suit Various Jobs and Sizes of Stock

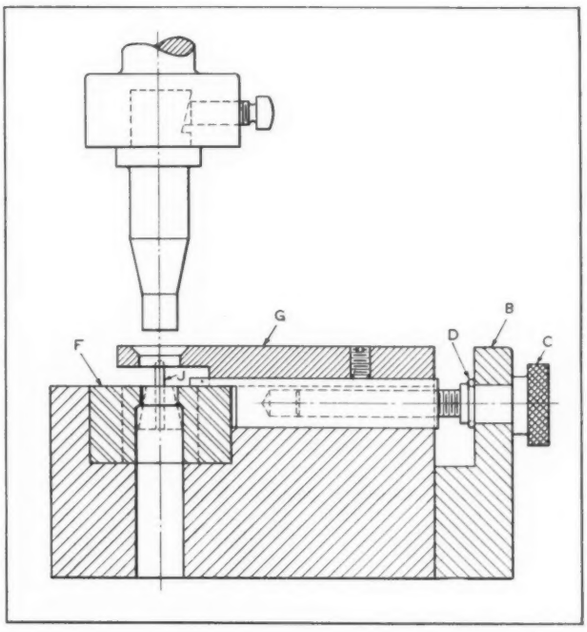



Fig. 2. Cross-section X-X of Die-shoe Shown in Fig. 1, and Side View of Punch

justed close to the punch or center of the die. Stop-rails *H*, consisting of 1-inch square stock with a 14-degree included angle slot milled through their centers, accommodate stop-slides *I*. As many of these slides as required can be employed. Slides *I* are inserted in stop-rail *H* and locked securely by means of 1/4-inch set-screws. The stop-pin *J* is inserted in the slide *I* and the work is moved up to it. When several slides *I* are used for work that requires the punching of a number of holes, the pin *J* is moved successively from one slide to the next.

## Using a Band Saw to Cut Sponge Rubber and Other Resilient Materials

By H. J. CHAMBERLAND

Very satisfactory results are obtained in cutting or slitting sponge rubber on a band saw by using a blade 3/8 inch wide that is given a tapered knife-edge in the manner shown in Fig. 1. A 1/6-H.P. motor is fitted with a grinding wheel of suitable grade and grain, such as is ordinarily used for knife-grinding. The grinding wheel rotates in the opposite direction to that of the blade, which has a speed of 1500 linear feet per minute.

It is essential that the blade be supported by a frictional drag eliminator guard, as shown in Fig. 2. This guard serves to spread or separate the material as the cutting proceeds. With this set-up, the blade cuts very smoothly and no lubricant is necessary, but paraffin applied inside the drag guard is beneficial. Powdered chalk rubbed over the table counteracts adhesion and permits the material to slide freely.

Best results have been obtained by having the blade protrude 1/8 inch outside the frictional guard. Contour cutting to a radius as small as 1 inch has also been accomplished very satisfactorily with this equipment. For this work, however, it is necessary to proceed slowly and hold or guide the work on both sides of the cutting band.

Another experiment in cutting sponge rubber, which also proved very satisfactory, consisted of using a saw blade 5/16 inch wide with 14-pitch raker-set teeth, the blade being first turned inside out so that the hooked or normal cutting

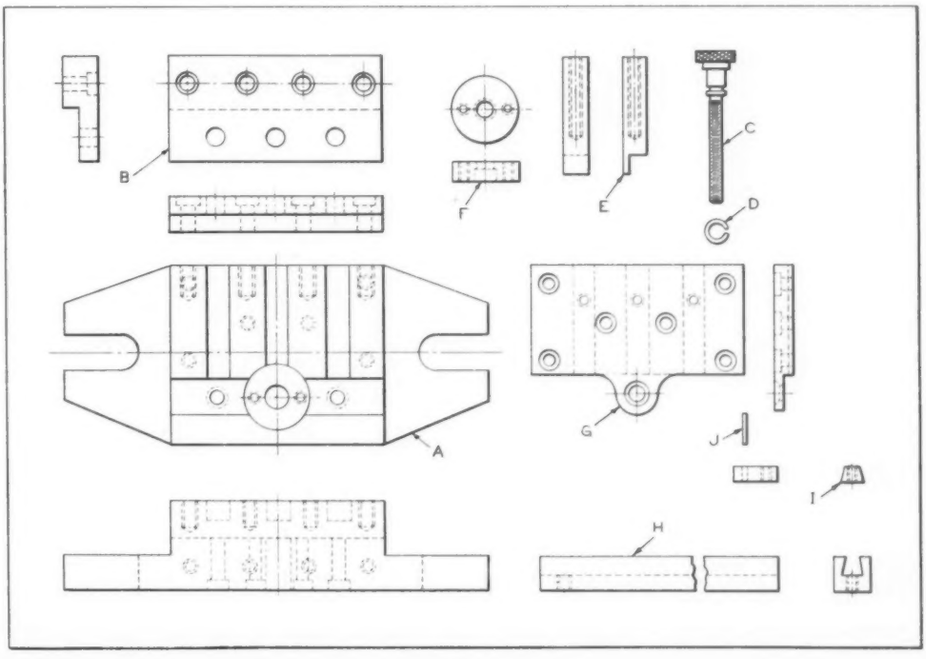



Fig. 3. Disassembled Parts of Die-shoe and Adjustable Stops

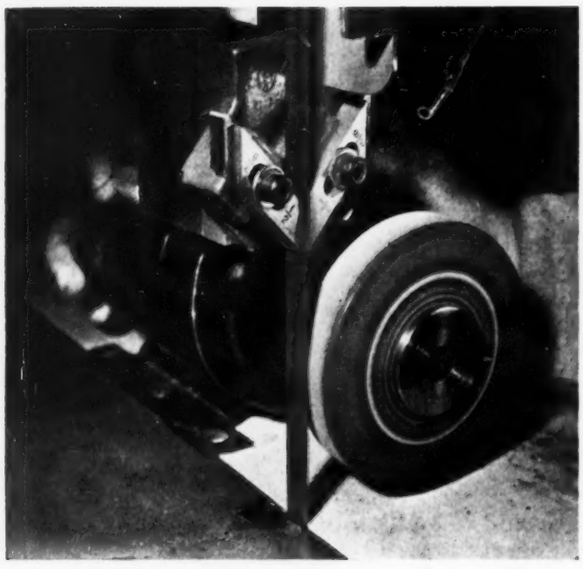


Fig. 1. Method of Grinding Tapered Edge on Band Saw Used for Cutting Sponge Rubber

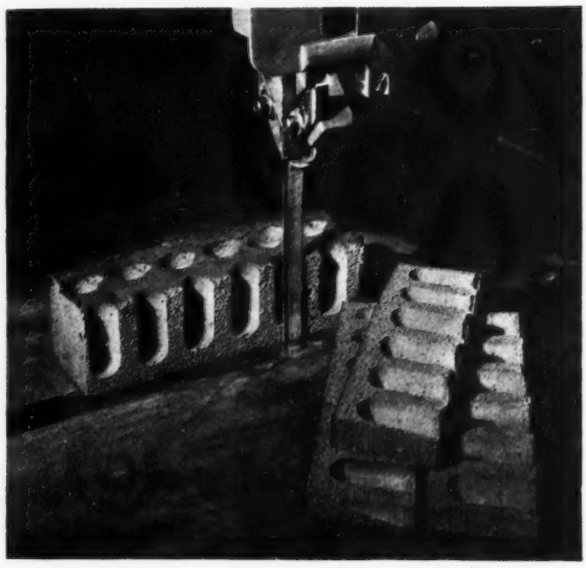


Fig. 2. Cutting Sponge Rubber with a Band Saw Having a Tapered Cutting Edge

sides of the teeth were in the following instead of the leading position.

The frictional drag eliminator guard is attached to the saw guides and must, of course, be correctly aligned, preferably with the aid of a straightedge. The cutting edge of the blade can be kept sharp by occasional touches with a fine abrasive stick. This equipment can also be used in a similar manner for cutting felt, paper, or any resilient material.

# What Free Enterprise has Done for America

REAL progress can only come from the labor of free men. . . . In a free country, government is merely an onlooker, demanding little except the power to enforce fair play.

Our whole system of free enterprise is founded on the demands of free men in a free country. When you as a private citizen demanded radios, you got them. When you demanded electric lights, you got them. When you demanded "horseless carriages" and the gasoline to run them, you got them. The same was true of a thousand other luxuries and necessities. You expressed your demands by buying a new product the instant it was put on the market by some enterprising individual. You continued to express your demands by looking tirelessly for the best at the cheapest price. Millions of businesses and industries have successfully striven to bring the miracles of science and invention to you. They are the same private enterprises that you have often booed and kicked around these many years.

Here is where you, Mr. Citizen, may learn the most precious lesson of this war. Private enterprise is serving you no longer. It is serving our Government, so that our country may survive in a world where most governments have directed the labor of the masses for many years toward nothing more productive than military power—the same years that American enterprise devoted to giving you a richer, fuller life.

In this world struggle, we are, of necessity, building a gigantic government, a gigantic military machine. Our free enterprise system is busy catching up with the slaves of the dictatorships. Until the war is terminated successfully, you will do without the pampering that you have received from free enterprise. It will probably do you good. While you are deprived of many of the products of industry, you will learn what free American enterprise did for you in the past. If the reason sinks in deeply enough, you may even learn that if you ever want free enterprise back, you will have to make it possible for it to come back.

A permanent big government with millions of employes would spell the end of free men, enterprise, opportunity, representative government—the end of the things that millions of American men are preparing to fight and die for in every corner of the world.—*L. Warren Ingalls, in the Kearsarge Independent*

# Ideas for the Shop and Drafting-Room

**Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work**

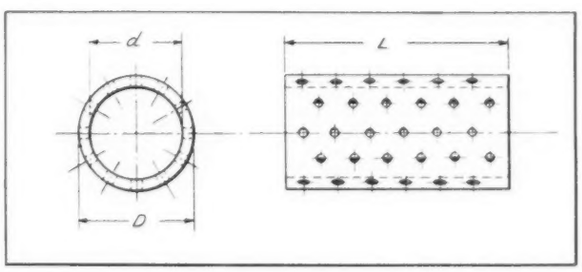
## Perforated Bearing Bushings as Substitutes for Ball Bearings

The writer claims no originality for the bearing shown in the accompanying illustration, which was first used many years ago and which the late A. J. Langelier termed a first cousin to a ball bearing. As such, it serves as a reliable substitute for anti-friction bearings at a time when the latter are difficult to obtain. The inside and outside diameters are made over size and under size, respectively, an amount equivalent to one-half the normal running fit for a shaft of given diameter. Thus, if a 1-inch shaft requires 0.003 inch for a running fit, then the diameter $d$ of the hole would be ground to 1.0015 inch, and the outside diameter $D$ would be ground to 0.0015 inch less than the diameter of the bearing hole in which it is to be inserted.

When installed, the bushing rotates with the shaft, gathering speed until, theoretically, it runs at half the speed of the shaft. Hence, the surface speed is reduced, so that a shaft ordinarily running at 750 R.P.M. in a plain bearing may be stepped up to 1500 R.P.M. without causing seizing or undue heating. The drilled perforations are from 1/16 to 3/32 inch in diameter; they are staggered about 3/16 inch apart, and spaced 30 degrees on the circumference. The perforations retain oil and aid in cooling.

For a hardened-steel shaft running in cast iron, a cast-iron bushing may be used; when once glazed and kept lubricated, it will run indefinitely without appreciable wear. A better installation is a bronze bushing running in a hardened-steel sleeve. Bushings and sleeves may be reamed, although it is preferable that they be ground.

Detroit, Mich. ANDREW E. RYLANDER




Perforated Bearing Bushing Used as Substitute for Ball Bearings

## Reconditioning Worn Blades Used on Power Hacksaws

The blades of power hacksaws employed in almost every kind of work shop are classed as non-durable. During reasonable ordinary use the teeth of these blades become dull and the practice has been to discard them as scrap material. In an effort to conserve the so-called strategic metals, the writer developed the following method of reconditioning these worn hacksaw blades:

Grinding Wheel Mounted on a Lathe Center Grinder for Reconditioning Hacksaw Blades

First, the back angle area of each tooth is slightly touched up by grinding, thus giving each tooth a sharp cutting point. The touching up is done by grinding the angular area on the side of and near the edge of a Norton black emery wheel, Type No. 46-L3L. This wheel is about 1/16 inch thick. The grinding is accomplished in a manner similar to that employed in sharpening drills and lathe cutting tools. The reconditioning of a saw blade requires about five minutes.

The illustration shows the grinding wheel mounted on a lathe center grinder, but the job could be handled on any machine shop grinder by truing the wheel by hand to the required shape. The hacksaw blades can be reconditioned several times before the set or clearance of the teeth disappears. Blades resharpened as described have been in satisfactory use for several months in cutting up such bar steels as S A E 3135, 4140, Monel metal, and stainless steel.

Providence, R. I. GEORGE COFFEY

* * *

In order to conserve automobile tires, the Diamond Tool Co., Chicago, Ill., has acquired a large power cruiser which it uses to transport its tool engineers and supplies to many of the defense plants that the company is serving in the Great Lakes district.

# Producing Thirty- and Fifty-Caliber

## Results Obtained by Changing over to Carbide Dies, and Recommendations for Carbide Die Design

By EARL GLEN
Carboloy Company, Inc., Detroit, Mich.

**Approved for Publication by the War Department**

THE prime reason for the rapidly increasing use of carbide dies for cartridge-case production — from the smallest to the largest sizes — is their greater resistance to wear. This reduces "down" time for die changes (thereby increasing output); it reduces the number of die reconditionings required; and it reduces the total number of dies needed for a given output. In addition, the reduced wear of dies of the carbide type insures greater uniformity of the product.

While the application has so far been primarily to the production of brass cases, indications are that carbide dies of the same basic design can be used equally successfully on steel.

Experience has demonstrated that, to keep production going, the ratio of dies required is only one carbide die to twenty tool-steel dies. Thus, 200 Carboloy dies will take care of a plant that normally would require 4000 steel dies for the same continuity and quantity of output, particularly when considering the possibilities of reworking worn dies.

In addition to the lower initial cost of die equipment for a given production, carbide dies also have demonstrated an advantage from the standpoint of operating costs. This is largely due to decreased die maintenance and fewer production delays for die changes, since there are not only fewer dies to take care of, but the dies do not have to be reconditioned as frequently. It is possible to get 1,000,000 pieces per carbide die change, against an average of 50,000 with steel dies. Production up to 4,500,000 pieces before the carbide dies required servicing has been reported. Carbide tapering and shouldering dies last almost indefinitely.

So far, carbide dies have been used largely in sizes interchangeable with tool-steel dies, dimensions having been based on the latter to facilitate substitution. If the use of carbide dies for such work increases—as is most likely—it probably would be desirable to give greater consideration to design for carbides in the construction of press equipment.

One of the points to be considered is that die recesses in presses should preferably be larger for carbide dies than for equivalent tool-steel dies. In carbide dies, the wall thickness is reduced by the amount of the carbide insert, and the case is thus slightly weaker. The larger die recess, die-shoe, or die-holder would (a) provide greater die-case support for the carbide insert, and (b) enable an increase in insert dimensions to give the die greater reserve for refinishing to larger work when worn.

### *Changing over to Carbides*

In starting to use carbide dies, it would probably be best to secure such dies in finished form from the die producer. However, from the standpoint of continuous operation, minimum cost, and freedom from delays, plants should provide as rapidly as possible thereafter their own service facilities for finishing and reworking carbide dies. When this is done, rough-cored dies can be purchased and finished in the cartridge-case plant, permitting further reduction in original die costs and reducing die-stock requirements to a minimum. This practice has been followed for years in wire-drawing mills, and is now established procedure in that industry.

Since the early days of carbide dies, grinding, lapping, and general reworking technique has been greatly simplified and improved. It is now possible to maintain carbide dies just as easily as those of tool steel. The Carboloy Company has for some time provided assistance to users in training die service men. As to service equipment, all that is required are standard tool-room speed lathes, flexible shafts, and diamond tools for boring. Some shops prefer, in place of the latter, a selection of diamond splints for pliers, for turning the inside of the dies.

### *General Production Procedure*

Irrespective of whether carbide or steel dies are used, manufacturers with experience in deep drawing have no major difficulties in setting up for drawing cartridge cases. The basic operations required for the production of 0.30- and 0.50-caliber cartridge cases consist of: Blanking and cupping; four drawing operations; three trimming operations; two indenting and heading operations; two tapering and shouldering operations (usually combined); one form-turning, one mouth-chamfering, one drilling or punching for vent at bottom of pocket or indentation, and a marking operation.

After each draw, the case is annealed, while before each draw, the case should also be pickled

# Cartridge Cases with Carbide Dies

to remove oxides, followed by immersion in rinsing baths, soaping, and a final hot rinse. The same applies to the cupping operations.

### *Blanking and Cupping Operations*

At present, practice is divided about half and half as to whether or not the blanking and cupping operations are performed by the cartridge-case producer. By far the better procedure is to have these operations, particularly the blanking, performed by the material supplier, in order to reduce the necessity of handling a large amount of scrap. Normally, it is advantageous to purchase the cups rather than disks, since the blanking and cupping can be combined in one operation. Sometimes the cupping die forms part of a two-piece die assembly, the upper half being for blanking. For the blanking portion of the die, tool steel is preferred. However, experimental work is being done also on carbides for this purpose. Where disks are purchased by the cartridge-case producer, the cupping can be performed in a die of the shape shown in Fig. 1.

### *Drawing Operations*

The established practice today is to use four draws. Where press equipment permits, drawing operations are usually performed in pairs, using two dies—an upper and a lower—the latter being self-aligning and generally of semi-floating construction. Carbide dies for these operations do not differ materially from steel dies. This is due primarily to the previously mentioned fact that the machines are designed originally for the use of tool-steel rather than carbide dies.

For the first draw, it is generally better to use a single rather than a double reduction. Some manufacturers eliminate one die in the second draw, making this also a single-reduction operation, particularly in drawing 0.50-caliber cases. Carbide dies lend themselves somewhat better to this than tool-steel dies, since they maintain their shapes longer.

To some extent, the die assembly depends on the press equipment available. Usually, where there is a sufficient length of press stroke, dies are assembled in pairs — two carbide dies replacing the usual double-reduction steel die—one above the other. On presses with limited strokes, a single carbide die may be used effectively. A die for this type of work is shown in Fig. 2. Figs. 3 and 4 show dies for the first and second operations, respectively, in shouldering and tapering cartridge cases. Fig. 5 shows a solid die used for form-drawing primer caps.

### *Recommended Die Design*

The accompanying table represents the results of an effort on the part of carbide die producers to simplify the production, maintenance, and procurement problems for cartridge-case manufacturers. The primary step in the simplification of dies was to group dies for consecutive operations so as to enable worn dies to be used again through a simple recutting process which may be carried out in the plant of the cartridge-case manufacturer.

Thus, it will be noted, only a single basic die size is now required for all draws for 0.30-caliber armor-piercing and tracer and ball jackets. At the outset, of course, it would be necessary to secure a group of such dies to finish to proper size. To simplify the problem, the rough-cored hole of this particular basic die is available in a series of stepped diameters, thus, reducing the amount of recutting required. After the initial set-up, it is usually necessary only to purchase dies for the last draws on the jacket, since the dies which they replace can be recut to take care of the earlier draws on the jacket.

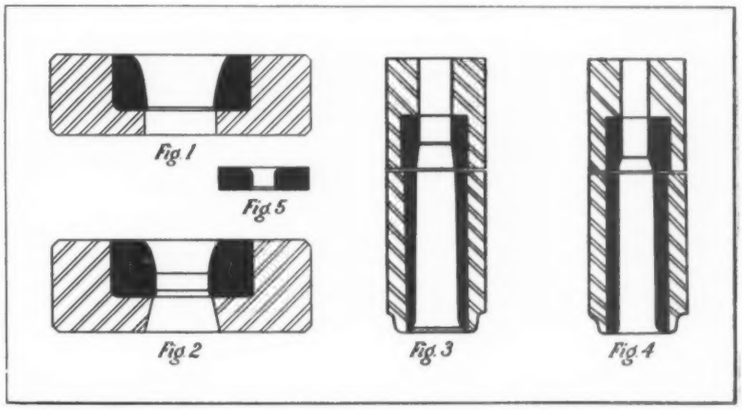



Fig. 1. Carbide Die Used for Cupping the Cartridge Case. Fig. 2. Die Design Suitable for Making Reduction Draws. Figs. 3 and 4. Dies for Performing First and Second Operations, Respectively, in Shouldering and Tapering Cartridge Cases. Fig. 5. Solid Die Used for Form-drawing Primer Caps

Similarly, for the 0.50-caliber jackets, two basic die sizes will take care of top and bottom dies for all draws. For the 0.30-caliber cartridge case, one basic insert "nib" and case size again takes care of all draws, as well as both top and bottom dies, where these are used in tandem. In addition, 0.30-caliber case dies are now interchangeable with the third and fourth draws of 0.50-caliber jackets. This gives greater recutting value and reduces the stock. In this case, there is a slight difference in approach angles between dies for different draws, and the rough-cored dies may be secured with these variations in angles for the initial set-up. The variation is so slight, however, that when a fourth-draw die is recut to a third-draw die size, the correction can be easily made in the die-refinishing operation.

For the 0.50-caliber cartridge case, two basic die sizes are required, the die for the first and second draws having a somewhat larger case diameter and height than the die used for subsequent draws. One advantage of this procedure is that the larger case provides additional strength for the initial reductions taken through a single die, as compared to the use of upper and lower dies for each of the third and fourth draws.

### *Stripping and Drawing Compounds*

With carbide dies, it is preferable to use a mechanical stripper, although some manufacturers strip with the dies on the reverse stroke, as with steel dies. In the latter case, the back edge of the die must be kept in good condition, as otherwise, the case will not strip properly and may damage the die or the punch. If the bottom die is used for stripping, a reverse taper of from 0.0002 to 0.0003 inch in the bearing is desirable. Some users of carbide dies provide a stripping edge on the die, and also utilize a mechanical stripper as an additional precaution.

As to drawing compounds, there are practically as many opinions as there are producers of cartridge cases. Not only are numerous types of compounds used, but the manner in which they are applied and diluted also varies. Some producers, for instance, dilute soluble oil 40 to 1; others dilute it to a thick emulsion. Some flood the dies and work, while others control the amount on both the inside of the die and the outside of the work by the use of felt wipers.

* * *

## War Greatly Increases Demand for Testing Machines

Because of the war, the demand for testing machines has increased tremendously. The Baldwin Southwark Division of the Baldwin Locomotive Works mentions that more orders have been booked by the company for testing machines in the month of July this year than during the entire year of 1939, which year marked the highest previous demand. The orders for testing machines during the first six months of 1942 were 80 per cent above those for the first six months of 1941.

* * *

## Electric Heat for Rustproofing

Metal stampings made by the Bettcher Mfg. Co., Cleveland, Ohio, are cleaned and rustproofed in a series of six tanks. Heat is applied by three General Electric Calrod immersion heaters. The stampings are conveyed from one tank to another by electric hoists. Compressed air causes the solution to circulate in the tanks, which are of 95 gallons capacity each. The cleaning is done with an alkali cleaning solution and a "heat bath" preparation made by the Chandler Chemical Co., Cleveland, Ohio.

Recommended Dimensions of Carbide Dies

| Part to be Drawn | Draw No. | Case | | Nib | | Rough Bearing Length, Inch | Finished Bearing Diameters, Inch |
|---|---|---|---|---|---|---|---|
| | | Diameter, Inches | Height, Inch | Diameter, Inches | Height, Inch | | |
| 0.30-caliber A. P. Jackets | All four | 1.995 | 0.500 | 7/8 | 3/8 | 3/32 | 0.305 to 0.496 |
| 0.30-caliber T & B Jackets | All three | 1.995 | 0.500 | 7/8 | 3/8 | 3/32 | 0.305 to 0.422 |
| 0.30-caliber Jacket | Size and resize | 1.110 | 0.432 | 5/8 | 5/16 | 3/16 | 0.306 |
| 0.30-caliber Cartridge Case | All | 1.727 | 0.625 | 1 | 1/2 | 3/32 | 0.4605 to 0.655 |
| 0.50-caliber A. P. and Tracer Jacket | 1 and 2 | 2.245 | 0.625 | 1 1/4 | 1/2 | 3/32 | 0.649 to 0.870 |
| 0.50-caliber A. P. and Tracer Jacket | 3 and 4 | 1.727 | 0.625 | 1.000 | 1/2 | 3/32 | 0.505 to 0.638 |
| 0.50-caliber Cartridge Case | 1 and 2 | 2.740 | 0.937 | 1 1/2 | 13/16 | 3/32 | 0.913 to 0.996 |
| 0.50-caliber Cartridge Case | All others | 2.370 | 0.625 | 1 3/8 | 1/2 | 3/32 | 0.793 to 0.880 |

# Roll-Forming Metal Sections in a British Airplane Plant

THE process of rolling sheet-metal strips into sections of various shapes, comparatively little used up till now, has become of considerable importance in airplane construction. Every type of airplane in production at the present time, in Great Britain at least, is fitted with stringers, channels, longerons, or stiffening members that are manufactured by rolling.

This article will describe the calculation of the allowances required in making the sheet-metal bends and the design of the rolls. The method of design advocated and the suggestions given are the result of practical experience, and the rolls illustrated are actually in use. To enable the method of roll design to be explained in the simplest manner, the reader is asked to place himself in the position of a tool designer confronted with the task of laying out a set of rolls for the stringer section illustrated in Fig. 1, using the data specified on the drawing of the section.

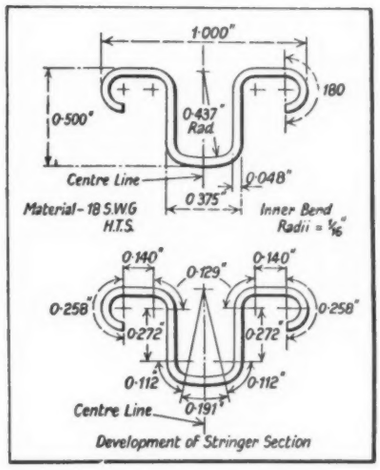



Fig. 1. Typical Stringer Section Produced by Roll-forming

In the first place, it is useful to know that the majority of rolling mills have either three, five, or seven stages. This means that they are capable of carrying three, five, or seven sets of rolls for performing a corresponding number of rolling operations. No section that can be rolled in, say, five operations should be put on a seven-stage mill, since incorrect loading of the machines only causes delay in production.

The section to be rolled should be carefully studied and an estimate made of the number of operations or stages needed to complete the work. Any curl or acute change in form—such as in the stringer section under consideration—should be rolled through an auxiliary box, as shown in Fig. 2. The number of rolling operations necessary governs the type of machine to be used. For the stringer section shown in Fig. 1, seven stages are required, and the rolls must be made to suit a seven-stage mill.

It is not necessary to make any further reference to the machine beyond pointing out that if a standard specification sheet is drawn up along lines similar to that shown in Fig. 3 (the rolls are dependent upon the dimensions given on the sheet), it affords a convenient and permanent reference. The data on the specimen sheet in Fig. 3 relate, of course, to the seven-stage mill used for manufacturing the stringer section shown in Fig. 1.

In estimating the number of stages required to complete a rolled section, no hard or fast rule can be given as to the work to be done at each stage. Every section must be judged on its own merits. Generally, the change in section must be as gradual as possible. Very short flanges, however, may be formed to 45 degrees or even 90 degrees in a single stage when the thickness of metal and the inner bend radii permit.

The length of the flanges governs the change in section. For instance, a section such as shown in Fig. 4 could not be

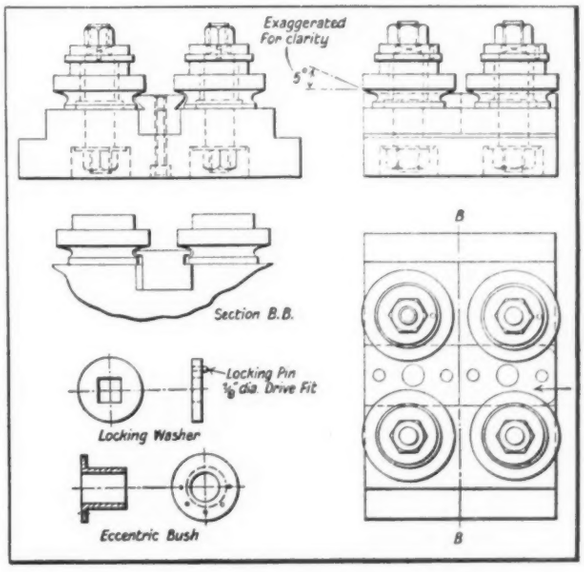



Fig. 2. Auxiliary Box in which the Third Stage of the Roll-forming Operation on the Stringer Section Shown in Fig. 1 is Performed

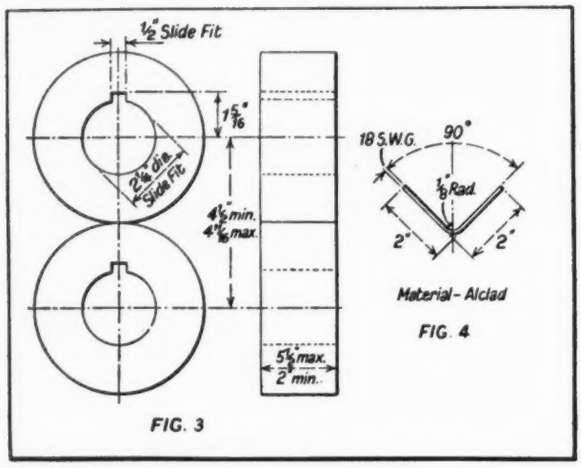



FIG. 3




Material - Alclad

FIG. 4

Fig. 3. Typical Standard Sheet for Use in Designing Rolls for a Roll-forming Machine
Fig. 4. Angle Section that must be Rolled in at Least Three Stages

rolled in one stage to an angle of 90 degrees, but would probably require three stages as follows: First stage, 15 degrees each side; second stage, 30 degrees each side; third stage, 45 degrees each side. It might even require an additional stage if the metal thickness exceeded 1/8 inch. Obviously, a certain amount of care must be exercised in laying out the forming operations to prevent straining the metal when rolling.

### *Calculating the Developed Width of Strip*

After deciding how many rolling operations are required and, consequently, which machine must be used, the next step is to calculate the developed width of strip. By the use of the accompanying bending allowance table, the calculation is considerably simplified. Take, for example, the 90-degree bend in the stringer section shown in Fig. 1. This may be calculated as follows:

Length of arc = radius × angle (in radians)

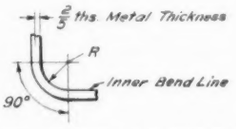
The radius extends to the neutral bending axis of the material, which is 40 per cent or two-fifths of the metal thickness from the inner surface of the bend. Thus, the radius referred to in this example would not be 0.062 inch, but 0.062 inch plus two-fifths of the metal thickness, which, in this case, is 0.4 × 0.048 = 0.019 inch; therefore, the radius = 0.062 + 0.019 = 0.081 inch. Hence, the 90-degree bend allowance (or length of arc) $= 0.081 \times \frac{\pi}{2}$.

With reference to the table, if any bend allowance other than 90 degrees is required, it can be obtained very simply. Thus, a 72-degree bend allowance $= \frac{72}{90} \times$ (90-degree bend allowance) or a 172-degree bend allowance = (90-degree bend allowance) + $\frac{82}{90} \times$ (90-degree bend allowance).

### *Drawing the Various Stages to Scale*

The next step is to prepare scale drawings of each stage, such as are shown in Fig. 5. For the sake of accuracy, as large a scale as possible should be chosen in laying out these stages. The reason for this can be seen when it is pointed out that should a drawing error of 1/64 (0.0156) inch occur on a scale lay-out that is twenty times full size, the error in the dimension of the actual rolls would be only 0.00078 inch.

Bending Allowances for Sheet Metal




The allowances are calculated from a radius extending a distance equal to two-fifths the metal thickness beyond the inner bend surface.

| Material Thickness, British Imperial Wire Gage | Allowance for 90-degree Bend at Various Radii (R in Inches) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/64 | 1/32 | 3/64 | 1/16 | 5/64 | 3/32 | 7/64 | 1/8 | 9/64 | 5/32 | 3/16 | 7/32 | 1/4 |
| 27 | 0.035 | 0.058 | 0.083 | 0.108 | 0.132 | 0.157 | 0.181 | 0.206 | 0.231 | 0.254 | 0.305 | 0.353 | 0.402 |
| 24 | 0.039 | 0.063 | 0.088 | 0.113 | 0.137 | 0.162 | 0.185 | 0.210 | 0.236 | 0.259 | 0.309 | 0.358 | 0.407 |
| 22 | 0.042 | 0.066 | 0.091 | 0.116 | 0.140 | 0.165 | 0.188 | 0.214 | 0.239 | 0.262 | 0.313 | 0.361 | 0.410 |
| 21 | 0.046 | 0.069 | 0.094 | 0.119 | 0.143 | 0.168 | 0.192 | 0.217 | 0.242 | 0.265 | 0.316 | 0.364 | 0.413 |
| 20 | 0.047 | 0.072 | 0.096 | 0.121 | 0.145 | 0.170 | 0.194 | 0.219 | 0.244 | 0.268 | 0.317 | 0.366 | 0.415 |
| 18 | 0.055 | 0.079 | 0.104 | 0.129 | 0.152 | 0.178 | 0.201 | 0.226 | 0.251 | 0.275 | 0.325 | 0.374 | 0.423 |
| 16 | 0.066 | 0.090 | 0.115 | 0.140 | 0.163 | 0.188 | 0.212 | 0.237 | 0.262 | 0.286 | 0.336 | 0.385 | 0.434 |
| 14 | 0.075 | 0.099 | 0.124 | 0.149 | 0.173 | 0.198 | 0.221 | 0.247 | 0.272 | 0.295 | 0.346 | 0.394 | 0.443 |
| 13 | 0.083 | 0.107 | 0.132 | 0.157 | 0.181 | 0.206 | 0.229 | 0.254 | 0.280 | 0.303 | 0.353 | 0.401 | 0.451 |
| 12 | 0.091 | 0.115 | 0.140 | 0.165 | 0.188 | 0.214 | 0.237 | 0.262 | 0.287 | 0.311 | 0.361 | 0.410 | 0.459 |
| 10 | 0.105 | 0.129 | 0.154 | 0.179 | 0.203 | 0.228 | 0.251 | 0.276 | 0.302 | 0.325 | 0.375 | 0.424 | 0.473 |

It is desirable, therefore, wherever possible, to use a scale about twenty times full size. If an accurate scale drawing is made, no error should exceed 1/64 inch, and, in consequence, no error in the rolls would be greater than 0.0008 inch. Each stage is laid out as shown in Fig. 5, and all the known and computed values—such as the distance between centers and the length of each bend—are subtracted from the total developed width of strip; the remainder is then divided by 2 to obtain the unknown lengths (designated as *X* in the illustration).

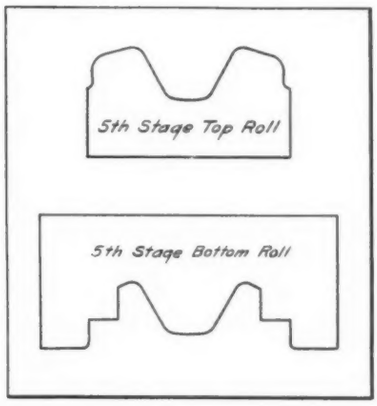



Fig. 6. The Templets for the Fifth-stage Rolls

The reason for bowing the metal in the second stage is that this channel section must emerge with its sides at an angle of 90 degrees with the top in order that it may enter the auxiliary box and be completely curled around to 180 degrees.

To find out how much bow must be imparted to the second-stage pair of rolls, it is essential to know how much the material will spring at the ends after leaving the rolls. This is very difficult to determine, as every batch of material will vary slightly. However, an approximate figure should be found from which the necessary calculations can be made. The metal used for the section shown in Fig. 1, for instance, has a spring-back of approximately 2 degrees. In order to determine the correct bow of the metal to compensate for this, two lines are drawn tangential to the inner bend radius at an angle of 2 degrees to the horizontal, and two lines each at right angles to the previous ones are drawn through the centers and produced to meet in a point. From this point, an arc is struck tangential to both of the two initial lines drawn, thus forming a bow.

Alternatively, this radius can be obtained by calculation, since, in any case, it is necessary to calculate the amount of metal in the bow in order to find dimension *X* and thus complete the drawing of the second stage. In making this or any other calculations for sheet-metal bend developments, it should be remembered that the effective radius extends to the neutral bending axis of the metal, which is two-fifths of the metal thickness beyond the inner bend surface.

At the third stage, which involves a curling operation as shown in Fig. 2, better results will be obtained by having two pairs of rolls—the first pair forming the metal to 45 degrees and the second pair to 90 degrees—than by attempting to use a single set.

On completion of the scale lay-out drawing of the various stages, the outline of each top and bottom roll should be drawn around the section, as shown in Fig. 5. The roll should support and guide the section as it passes through, the support being arranged so that no uneven flow of metal can occur. For this reason, the section is kept symmetrical about the center line.

Dimension *B* (see fifth stage) should be such as to accommodate the section from the previous stage and should be scaled from the lay-out of the previous stage. For example, dimension *B* at the fifth stage should be scaled from the over-all section in the fourth stage. This width of roll enables the section to be fed in from the previous stage without any distortion of the metal. The dotted lines represent the rolls, and, in consequence, also represent the upper and lower templets to which the rolls are machined, as shown in Fig. 6. Since the scale drawing is

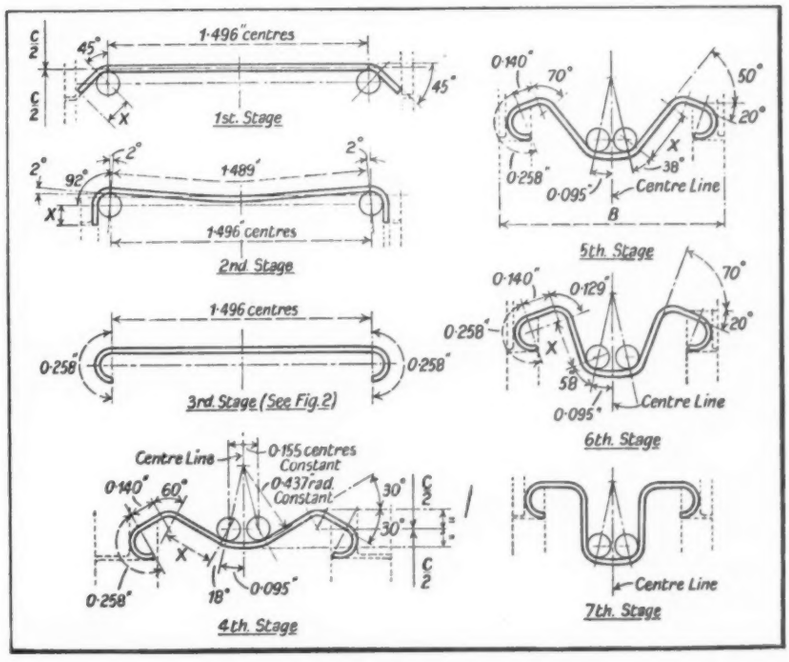



Fig. 5. Scale Lay-out from which the Rolls are Designed for the Various Stages in the Roll-forming Operation

greatly magnified, all the unknown dimensions for the templets may be taken from the drawing and reduced to scale.

Various calculations have been made with regard to the springing of centers and the springing out of the metal after the strip has passed through each stage. This point can be better explained by referring to Fig. 5. After the material has passed through the first stage, the flanges spring out from the rolled angle of 45 degrees to a slightly smaller angle, and, in consequence, the centers of the bends move inward. The amount by which the centers of the bends move inward must be determined and the center distance for the first-stage rolls must be made larger by this amount. In addition, the springing out of the flanges after passing through the first stage results in an increased over-all width of the section and dimension *B* on the second-stage rolls must be made large enough to accommodate this increase.

These calculations should be repeated for each consecutive stage and for each set of centers required. However, it will be found that for the average-size rolled sections, the centers rarely move in more than 0.002 inch, nor does the over-all width of the section spring out more than 0.002 or 0.003 inch. This small amount is negligible, and in the majority of cases these calculations are unnecessary.

To obtain the peak diameters of the rolls as shown in Fig. 7, the question of equal peripheral speed of each pair of rolls must be taken into account. In order for the rolling surfaces of the rolls to run at approximately equal speeds, the centers of the rolls must be equidistant from a line that runs midway between the extreme rolling surfaces. This is clearly indicated at the fourth stage in Fig. 5. It can be seen that if the surface speed of the top roll is the same as the surface speed of the bottom roll, then both will be subject to the same amount of wear. In the first stage shown in Fig. 5, it is sufficient to make the roll centers equidistant from a line which runs through the center of the metal thickness.

### *Stepping up the Centers*

As there is a certain amount of adjustment on the centers of the rolls in most rolling mills, it is advisable to increase the center distances about 0.020 inch at each stage after the first. By thus increasing the center distances, the peripheral speed of the last pair of rolls is made greater than that of the others due to the larger diameters. This being the case, the maximum surface speed of the metal occurs as it passes through the last pair of rolls. In other words, as the section passes through the rolls from one stage to the other, a pulling or drawing action is exerted on it. This tends to keep the metal taut and straight. When the diameters of the rolls decrease at each succeeding stage, the material tends to buckle between each operation. This, of course, is undesirable and should be avoided where possible.

The speed of the rolls can be varied on most machines; but, as a general guide, a surface speed that gives an output of 25 feet of rolled section per minute can be safely selected for all metals. Mild steel rolls that have been pack-hardened will be found satisfactory for all soft non-ferrous metals. For high-tensile steel and similar materials, the rolls should be of cast steel, hardened and tempered.

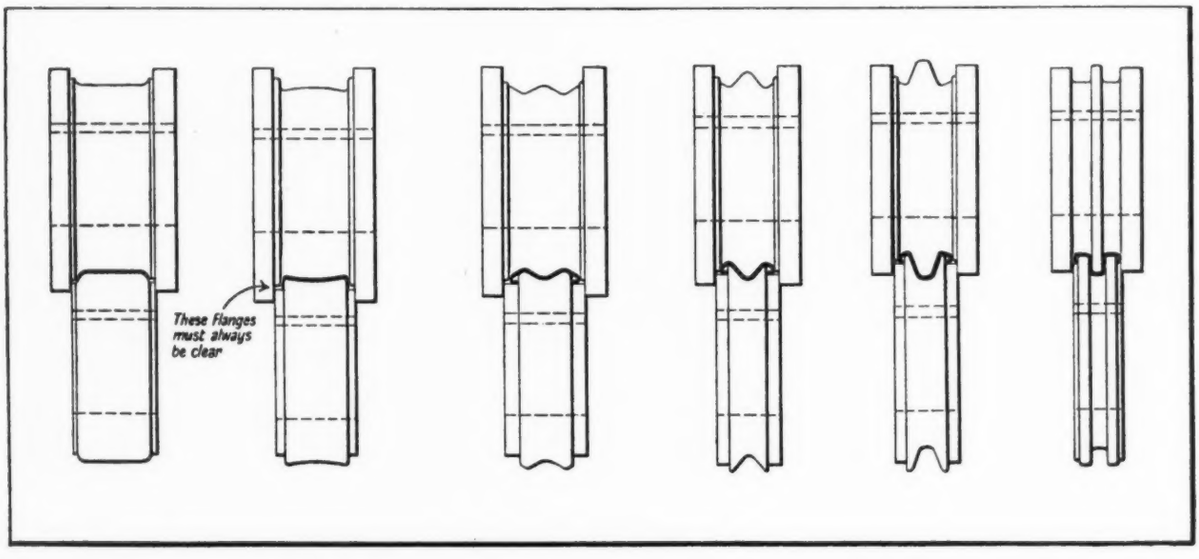



Fig. 7. The Rolls for the First, Second, Fourth, Fifth, Sixth, and Seventh Stages in the Production of the Stringer Section Shown in Fig. 1

# Cleaning Small Bearings

By MARTIN STEINHARDT

THE problem of bearing cleaning cannot be solved by a single all-embracing method. The variety of types and sizes of bearings makes it impossible to classify any equipment in general terms as "bearing cleaning machines." Individual cleaning methods must, therefore, be found for different types and sizes of bearings. This brings bearing cleaning into the realm of custom cleaning.

In segregating bearings into groups, however, too fine a distinction should not be drawn between the types and sizes. Judgment must be exercised in order to obtain a maximum number of cleaned parts.

Work-holding Baskets Used in Machine for Cleaning Bearings

Let us, for the moment, concern ourselves with the cleaning of small bearings—bearings that can be contained in a work-basket that is 2 5/8 inches inside diameter by 2 1/4 inches deep. A work-basket of that size is used in the cleaning machine made by the L. & R. Manufacturing Co., Newark, N. J. This machine has been used successfully by watchmakers and jewelry manufacturers, and is especially adaptable to bearings. It cannot be used, however, on bearings that do not allow for a reasonable flow of the liquid cleaning compound through the balls and into the races. There are, nevertheless, enough of the open-side bearings (open on one or two sides) to warrant giving this method consideration.

There are six simple steps in small-bearing cleaning procedure:

1. The bearings are placed in the large work-basket of the cleaning machine (see the accompanying illustration). A triple-basket arrangement covering the same area as the large work-basket is also provided in this machine for the smallest sized bearings. This consists of a frame holding three small baskets, each 1 7/8 inches long by 1 3/4 inches deep by 7/8 inch wide.

2. The work-basket is snapped into position on the motor-shaft of the machine. It is then lowered into the first jar, which contains a cleaning compound, and agitated centrifugally. The motor of the machine is rheostat-controlled; the speed of the basket can be stepped up to approximately 1000 R.P.M. This mechanical action, in addition to the chemical action of the cleaner, cuts and removes grease, grime, oil, lapping compounds, etc., without causing rust, corrosion, or removal of metal; any metal particles lodged between the balls in ball bearings, however, are forced out.

3. After having been immersed for about three minutes in the cleaner, the basket is transferred to the second jar, which contains the first rinse. The agitation is continued. This solution, in which the cleaner is soluble, removes all traces of the first solution from the bearings and the remainder of the oil that may adhere to it. All metal particles are also ejected at this time.

4. The bearings are now rinsed in the third jar (which contains the same compound as that used in the second jar). This compound will always remain clear if the bearings have been properly cleaned and rinsed in the first two jars. The last wash acts as a final check and polishing agent.

5. The parts are now ready for drying. The drying chamber is equipped with a Chromalox heater unit and a separate motor-driven fan. Here the bearings are thoroughly dried and made ready for examination.

6. By now, all grease, oil, and grime should have been removed from the bearings. If metal particles remain, as they will in some cases, a pressure air blower should be used. Since the fragments now have no support in any soft foreign matter, they are easily removed by well directed blasts of air.

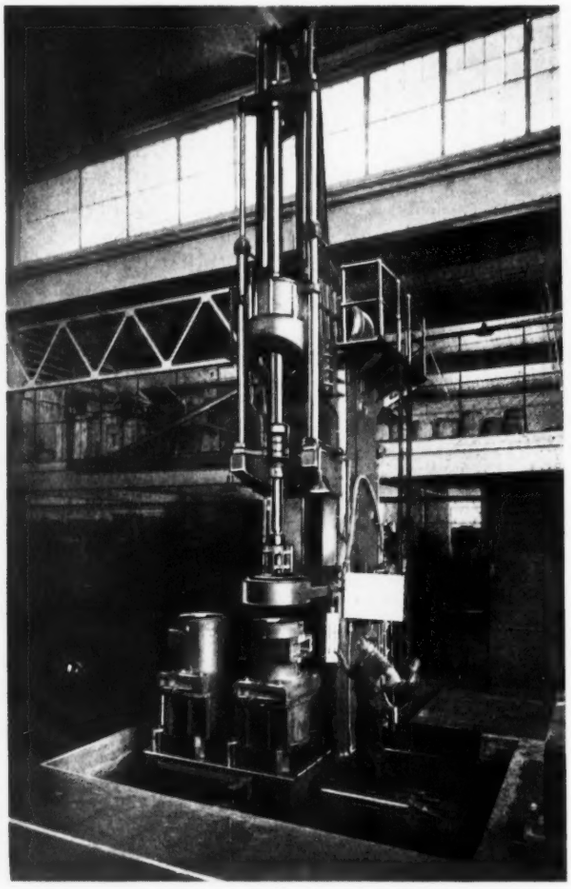
When very small, delicate bearings are removed from the machine, the outer race should not be revolved, because remaining metal particles may injure the balls. For such bearings, always use a pressure air blower as an added precautionary measure. Sixty pounds filtered air pressure is sufficient.

The method described has been found effective in many plants throughout the country. The compounds used in the machine are non-corrosive, non-aqueous solutions, and non-toxic. They contain no chlorinated solvents and no oxalic acid. The flash point is about 108 degrees F.

* * *

## Cooper-Bessemer Installs Huge Honing Machine

A machine that will hone cylinders with bores up to 26 inches in diameter and 6 feet long has been designed and constructed by the Cooper-Bessemer Corporation, one of the nation's leading manufacturers of Diesel engines, and has been erected at the company's Mount Vernon, Ohio, plant. The machine has an over-all height of about 20 feet. It was designed and built by the corporation because, at the present time, manufacturers who build large honing machines are unable to undertake the design and building of a special machine of this kind due to priority orders for standard equipment.



Honing Machine Having a Capacity for Honing Compressor or Diesel Engine Cylinders 26 Inches in Diameter by 6 Feet Long

## Exhibit of the Taylor-White Steel Research Work

An exhibit commemorating the Taylor-White development of high-speed tool steels was recently built by the Bethlehem Steel Co. and presented to the Smithsonian Institution, in Washington, D. C. Beginning in 1898, Frederick W. Taylor and Maunsel White, metallurgist of the Bethlehem Steel Co., carried out a series of experiments at Bethlehem, Pa., during which they discovered an entirely new type of tool steel. Their work led to the development of high-speed steel, which revolutionized the entire machine tool and machine shop industry.

The main feature of the exhibit is a small-scale reproduction of the original Taylor-White laboratory in Bethlehem, with replicas of their lathe, heat-treating furnaces, and the optical thermometer constructed for this test, one of the first of this type used in metallurgical work. Some of the original tools made by Taylor and White are also included.

* * *

## Need for Standardized Thicknesses of Thin Sheet Metals

In a recent number of *Industrial Standardization*, H. W. Robb of the Standards Department, General Electric Co., points to the need for better standardization of the thicknesses of sheet metals. He calls attention to the fact that there are a number of gage systems used to designate such thicknesses, and points out that gage-number systems are unsuitable for design and manufacturing purposes, because they create undue confusion. A system has been developed known as the "American Standard on Preferred Thicknesses of Sheet and Strip Metals." This is designated the American Standard B32.1–1941. This standard is a logical series which covers general-purpose industrial requirements with a minimum number of thicknesses. Mr. Robb is of the opinion that many advantages could be obtained by metal manufacturers and users alike if they were to adopt the standardized thicknesses.

* * *

According to information published by the Automotive Council for War Production, the automotive industry, in August, turned out armaments for the United States and allied governments at an annual rate exceeding, by more than 20 per cent, the output achieved during the highest peak-year ever reached in peacetime production of automobiles, trucks, and other automotive products.

# Tool Engineers to Meet in Springfield, Mass.

WHEN the American Society of Tool Engineers meets at Springfield, Mass., Friday and Saturday, October 16 and 17, the keynote of the discussions will be "War Production." The headquarters of the meeting will be at the Kimball Hotel. Representatives of industry from all the fifty-four chapters of the Society are expected to participate in the meeting. Five sessions, each stressing a vital question that faces industry today, have been scheduled.

A conference on emergency training will open the session on Friday morning. At that time, means will be discussed for expediting the training of new, as well as skilled, labor, including women, to meet the already growing shortage of industrial workers in the war plants. Friday afternoon will be devoted to the subject of inspection. An attempt will be made to point out how inspection specifications called for by the Armed Services could be made to conform more nearly with those normally employed in the manufacture of precision products. If this could be done, needless checking of details not vital to the satisfactory operation of the product could be avoided.

With the current emphasis on production rather than new tooling, the question of conservation of cutting tools, in order to insure an adequate supply, has been allotted a separate session Friday evening. Methods of salvaging tools that normally would be called worn out will be given especial attention. The matter of salvage is of great importance, since practically all cutting tools contain a considerable amount of tungsten, which has become a vital war material.

At the morning session on Saturday, war tooling and conversion to war production will be discussed. A forum on material substitution has been scheduled for Saturday afternoon. At that time, it is hoped that the discussion will bring out much useful information regarding materials to meet shortages now existing through the substitution of less scarce materials.

Frank W. Curtis, chief engineer of the Van Norman Machine Tool Co., Springfield, Mass., and a past-president of the American Society of Tool Engineers, will be chairman of the meeting. Many Army and Navy officers from the ordnance districts and arsenals throughout the United States will be guests of the conference, and an exhibit of products manufactured in the northeastern states will be on display at the Hotel Kimball.

# Foremen Rewarded for Efficiency in Shell Manufacture

A PLAN for rewarding foremen in accordance with their performance over certain periods has been put into practice by the American Car & Foundry Co. at its plant making shells for the Allied Nations. The purpose of the plan is to improve the quality of foremanship by means of meetings, discussions, and instruction; and, further, by the establishment of a cash incentive, to make the foremen more alert to their duties and responsibilities.

The chief element to be considered is the foreman in relation to the performance of his men. The awards are based upon percentage ratings of the following items:

1. Total number of hours worked as compared with a par value.
2. Attendance record of the foreman and of his men.
3. Punctuality of the foreman as recorded by the time-clock.
4. Reduction of scrap or spoiled material due to poor workmanship in relation to the production of the department.
5. Reduction of defective machining in proportion to the production of the department.
6. Reduction of cutting tool costs.
7. Reduction of costs of operating supplies in comparison with an established limit.
8. Reduction of cost of indirect labor in comparison with an established limit.
9. Percentage of day work in the department.
10. Reduction in the number of machines "down" in the department and number of machine-hours lost.
11. Safety record of the department.

In addition to the foregoing, the foremen are judged and marked for certain intangible qualities, such as their conduct, energy and personality, knowledge of their job, judgment and common sense, cooperation, leadership, initiative, cleanliness of the department, and how they get along with their men.

Commenting upon the plan, M. S. Evans, district manager of the company, says: "While the plan may not be altogether perfect, it has produced very tangible results in awakening the men to their responsibilities. It has opened their eyes to undesirable conditions existing in their departments and has resulted in the saving of a considerable amount of money."

# How to Organize a Scrap and

**A Detailed Account of how Henry Disston & Sons, Inc., Philadelphia, Pa., Organized a Salvage Department and Handled the Scrap Disposal Problem**

WHEN we decided to tackle the scrap and salvage problem in our plant, we placed a man in charge of the salvage work for our entire establishment and delegated to him considerable authority for making decisions regarding what was to be scrapped. This man selected a committee of eight representatives from our operating division, purchasing department, engineering department, personnel department, and general office to help him formulate plans for the operation of the salvage program. After the plans were formulated, the superintendents of the various manufacturing divisions informed their foremen as to the part they were to play in carrying out the instructions issued to them by the salvage supervisor.

With the aid of signs, War Production Board posters, and posters of our Disston Conservation Plan, to be mentioned later, together with the educational work of the committee and foremen, we started on the first phase of the salvage program, which was a general house-cleaning. This house-cleaning was not started simultaneously in all departments, but was staggered throughout the plant, in order to avoid interrupting production unduly. The employes were asked to drag everything out into the daylight from all nooks and crannies, from under benches, and out of drawers — anything that was thought to have a value and that was not being used.

After the various materials were brought together, it was necessary to segregate them. Non-ferrous metals were separated from ferrous metals, and the non-ferrous metals were further segregated into lead, babbitt metal, nickel, copper, aluminum, etc. Cast iron was separated from machine steel and tool steel, old rubber belting was separated from leather belting, and the paper collected was separated into two grades and baled. In six weeks, about 50 tons of waste paper was disposed of.

All scrap and chips from manufacturing processes were kept separate according to the kind of steel machined, since there is a higher salvage value for segregated grades of scrap than there is for mixed scrap. By so doing, it was found that a considerable amount of scrap that had formerly been sold in mixed lots could be used in our own electric furnaces for

*Quantities of Scrap being Shipped from the Plant of Henry Disston & Sons, Inc.*

★

# Salvage Campaign

By S. HORACE DISSTON, President
Henry Disston & Sons, Inc.

remelting, particularly scrap that contained scarce alloys. All lead bushings from emery wheels are being saved, and certain grades of old wheels are being sold to reclaimers of the abrasive grain from which the wheels were made. After the house-cleaning phase had been taken care of and all waste material around the yard and in the shop gathered together, a procedure was adopted for the future handling of such scrap.

Then the second phase of the program was approached—a thorough study of the continued usefulness of all punches, dies, jigs, fixtures, tools, etc. These were carefully sorted and inspected, and put to use whenever possible; or the metal was salvaged for use in other tools or fixtures; or, where this was not possible, the tools were scrapped and either melted in our own electric furnaces or sold to scrap dealers.

The third phase of the program was a study of obsolete machinery. Each foreman was asked to submit to the salvage department a list of unused machines and equipment. This department then listed them with the factory number, description, date of purchase, original price, and present value. This information was then presented to the divisional superintendent to obtain his authorization to transfer, sell, or scrap. It was found that a letter relating to each piece of equipment written to the chief engineer sometimes brought forth valuable suggestions for possible use, ideas regarding repairs, or advice to sell or scrap.

Machinery for which no use could be found was broken up and sold as scrap, particularly when there were missing or broken parts. Pulleys, shafting, set-screws, and similar accessories that were of value and could be used were removed from the machines before they were broken up and sent to the store-room for future use.

Sometimes, in examining what was thought to be obsolete machinery, it was found that the machines could be put to a useful purpose with some revamping and adaptation. Standard milling machines, lathes, grinders, woodworking machinery, etc., which had a real value as second-hand machines were offered to the used machinery dealers. A considerable amount of equipment was disposed of in this way.

It is astonishing to find what a large amount of scrap and salvage material can be brought to light in a large plant when an intensive effort is made to do a real job. We are quite satisfied that, in addition to putting back to use the materials salvaged, the procedure has had a useful effect on the workmen in keeping everything in order.

Another subject of interest in this connection is the Disston Conservation Control Plan. We believe that the time to start a salvage job is before any waste takes place. This plan,

*Scrap being Collected in One of the Yards of the Plant of Henry Disston & Sons, Inc.*

★

therefore, was inaugurated as a nation-wide effort. Much waste is caused through carelessness and through the improper use of tools in the workmen's hands. We have tried to suggest to the purchasers of the various tools we manufacture the idea that there is only going to be so much steel available for use in the manufacture of many of the items which are most essential for the war program, and therefore, everyone should endeavor to see that all tools are used to the best advantage.

In order to help educate the workmen who may be using files, hacksaw blades, metal-cutting band saws, circular metal-cutting saws, and other tools that the company manufactures, we have devised a series of cards, which someone has aptly termed the "Pocket Foreman," explaining the cause and prevention of failures of tools. With this information in the hands of the users of the various tools manufactured, there should be longer life of the tools and conservation of the materials on which the tools are being used.

This company has found a ready acceptance by industry generally of this contribution to the conservation program. In addition to the "Pocket Foreman," we have posters which are sent to any plants willing to cooperate, and buttons for the men to wear, indicating that they are cooperating with the program. Finally, we send to any cooperating company a certificate indicating that the company is helping in the conservation of materials in the interest of the national War Production Program.

# The Chobert Riveting Machine in Aircraft Production

THE Chobert riveting machine gun, although used in France for the last few years, is not so well known in America. It is now being made available for use in this country by Airsealand Aircraft, Inc., Long Island City, N. Y. The gun is not sold by this company, but is rented and serviced by it for a period of five years. It is claimed that an operator and helper can drive ten thousand rivets in an eight-hour shift with this tool. The riveting is done entirely from one side of the assembly, no bucking bars being needed. Unsupported thin sheets of aluminum can be riveted without causing the sheets to buckle, since reaction takes place only between the riveting mandrel and the gun, no pressure being applied on the plate itself.

The riveting machine gun, as shown in Fig. 3, is composed mainly of a barrel and a cam, the latter being operated by a crank. The rivets are threaded on a long steel mandrel having an upset tapering head, as illustrated in Figs. 1 and 2. This mandrel serves as a magazine feed and is pushed into the riveting gun, where it is clamped in the jaws of a chuck. Instead of the rivet being pushed out past the mandrel, it remains stationary and the two front chuck jaws come forward into contact with the rivet head, as shown in Fig. 2. After the mandrel and rivet have been inserted through the rivet hole, the mandrel is pulled back through the hole in the rivet by means of the crank-operated cam and gear mechanism of the riveting gun, which exerts a force of about one thousand pounds. This action expands the rivet, as indicated in Fig. 1. The crank action is so smooth and light that the riveting gun can be easily employed by women operators.

It is only necessary to rotate the handle three times to complete the riveting operation. One and one-half revolutions of the crank causes the cam to push the thrust roller outward, and this, in turn, causes the whole machine riveting gun barrel to be pushed forward, resulting in forcing the rivet over or past the end of the mandrel. When the cam once reaches the height of its rise, it falls back quickly, allowing the whole barrel assembly to slide to the rear. At this moment, a control fork, still being acted upon by the cam, keeps the two chuck jaws in a forward position and opens them in such a manner that another rivet is automatically brought into position for the next operation. An ingenious mechanism, similar to a free-wheel slide, comes forward when the barrel advances, but remains in place during the backward movement, so that rivets are continually fed into the jaw chuck. Thus, all the work is accomplished by simply turning the crank of the riveting gun.

Fig. 1 shows how the mandrel expands the rivet to fill irregular and over-size holes, and in addition, produces a shoulder having ample shearing strength. This shoulder, although it appears small, is still stronger than the head of the rivet. Inaccurate drilling of over-size holes is automatically taken care of by the over-size expansion of the rivet, which will fill in spaces like those shown in Fig. 2. Variation in sheet thicknesses from 0.080 to 0.100 inch can be taken care of by one length of rivet. Thus the 3/16-inch rivet is suitable for sheets having a thickness ranging from 0.045 to 0.130 inch.

In setting the rivet, a straight cylindrical bore is produced through its center. This permits the rivet to be converted into a solid type, since small pins 0.001 inch over size can be driven into the hole. These pins will stay in place and remain water-tight. Thus, the rivets can be used for floats or seaplanes.

The rivet and the mandrel are manufactured within tolerances of 0.001 inch. The rivets are furnished in snap-head and countersunk-head types in the different sizes, the most common sizes being 1/8-, 3/16-, 1/4-, and 5/32-inch in diameter; for special jobs, rivets of 1/2 inch in diameter are available. They are made in the materials most commonly used in aircraft manufacture, including such materials as 17 ST, but rivets of other metals, such as monel, brass, and steel, can also be used.

* * *

Our commanders say our place is here in the great arsenal of all armies of Democracy. Here, then, we serve, and here we serve not only our great cause, but here we serve each other too. Serve by forging a mighty chain in which we are all linked together in the great comradeship of men fighting a war for freedom. And every time a man flashes hope and confidence and courage, every time a man makes it easier for others to bear their death-watch and endure all that we shall yet be called on to endure; every time a man does that and does it with the full glow of courage, he fires a gun for victory; he conquers a citadel of opposition. So let us all who are in this home army, whether we are in overalls or business suit, join hands together and feel together the most lasting and greatest satisfaction of all — the one which comes when we serve each other. Until from every mountainside, freedom rings.—*Edgar T. Ward's Sons Co., in its publication "The Shaft."*

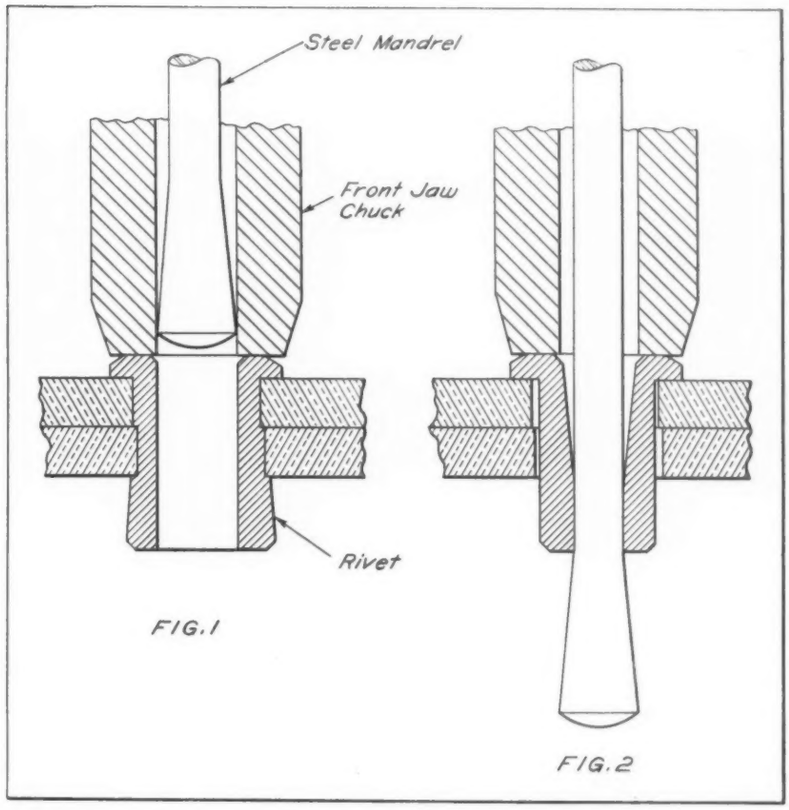



Fig. 1. Cross-section through Rivet and Metal Sheets
Fig. 2. Cross-section of Rivet and Sheets before the Rivet is Set by the Chobert Riveting Gun

* * *

The American Gear Manufacturers Association reports that industrial gear sales for July, 1942, were 15.4 per cent above July, 1941.

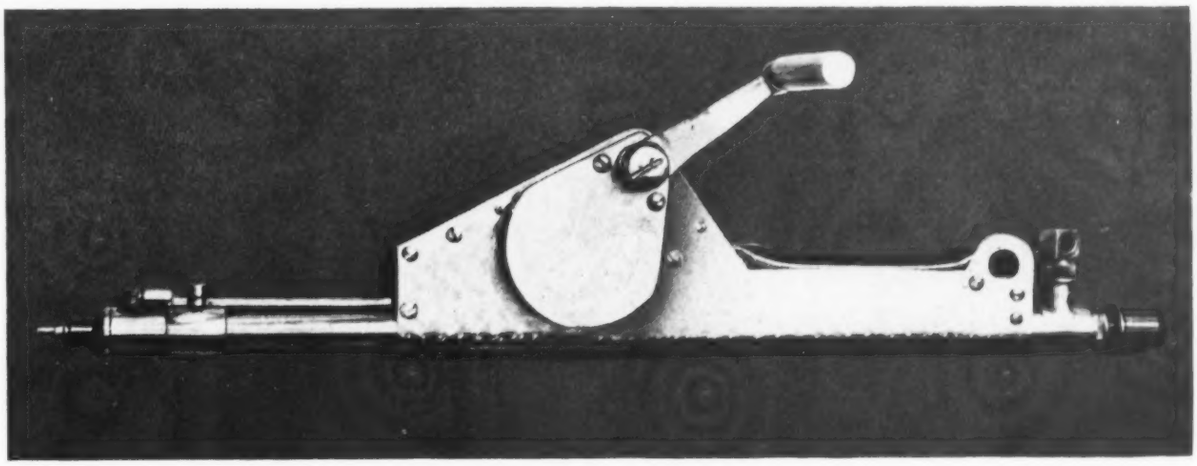
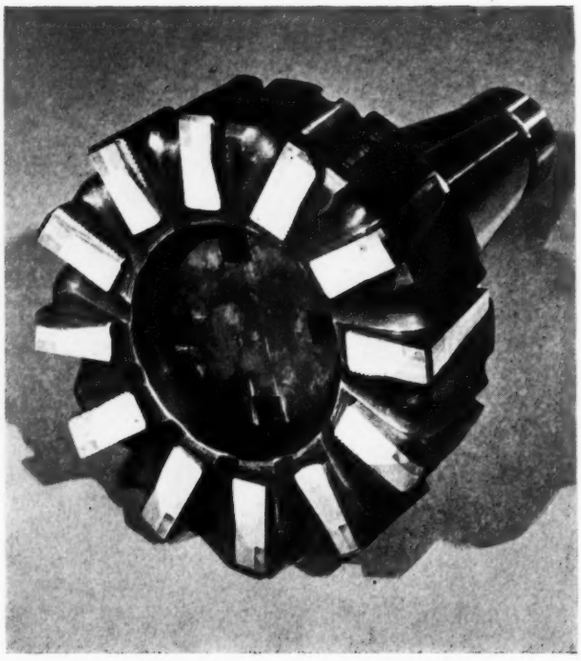


Fig. 3. Chobert Crank-operated Riveting Machine Gun

# New Method for Milling with

AN entirely new method of face-milling steel with Firthite sintered-carbide tipped inserted-blade cutters is being recommended by the Firth-Sterling Steel Co. for certain types of milling work. This method, which has been given the name "hyper-milling," differs from standard face-milling practice, not only because the unusually high speeds at which the tools operate result in increased production rates, but also because the method can be applied to the milling of hardened and heat-treated steels, including alloy and other tough steels which either are difficult, or practically impossible, to work by the more conventional methods.



Six-inch Diameter End-mill with Twelve Firthite-tipped Teeth Ground to a 10-degree Negative Radial Rake and a 5-degree Negative Helix

While the usual milling cutter might be compared to an ordinary carpenter's plane in which the tool digs into the work, the new method is comparable to a carpenter's scraper in which the angle of the tool is reversed. In some respects, hyper-milling is like an ordinary milling cutter working backward, with teeth reversed, at a much higher speed.

In general, production has been increased from two to four times on operations where hyper-milling has been used, as is shown by the following typical applications, which have been highly successful:

Forgings of annealed S A E 3145 steel, 2 1/2 by 4 1/4 by 20 inches, have been face-milled with a 6-inch diameter cutter having twelve Firthite T-16 tipped teeth set at 10 degrees negative rake and 5 degrees negative helix, with a life between sharpenings of from 8 to 12 hours, at 1/16-inch depth of cut, 365 R.P.M., (or 575 feet per minute), and 4 1/4-inch feed per minute (or about 0.0016 inch per tooth per revolution).

Heat-treated S A E 4340 steel of from 180,000 to 200,000 pounds per square inch tensile strength, and nearly 400 Brinell hardness, which is practically unmachinable with high speed steel cutters, is being milled at 1/16 inch depth of cut, 3 3/16-inch feed per minute, 247 R.P.M. (or 388 feet per minute) with a 6-inch diameter cutter. The cutter life is in excess of 8 hours.

Armored vehicle parts are being milled at 1/16-inch depth of cut, 2-inch width of cut, 180-degree length of cut, using a 6 1/2-inch diameter cutter having 14 teeth, 342 R.P.M. (or 585 feet per minute), with a feed of 15 inches per minute (or 0.0031 inch per tooth per revolution). The tool life is three pieces per grind on this exceptionally hard material. In this case, a 5-degree negative rake land, 0.005 inch wide, was honed on the cutting edge of each tooth.

The advantages of hyper-milling are manifold. The cutting edge is greatly strengthened, as a lip angle greater than 90 degrees is used. The center of the cutting pressure is some distance behind the cutting edge. The negative angles delay cratering, pitting, wear, and chipping. Despite the omission of any cutting fluid, both the work and the cutter remain cool, resulting in a minimum of distortion, even of fragile pieces. The light feed results in less strain on the work and on the machine.

The essential feature of hyper-milling is that both the rake and helix angles of the cutters are negative (up to 10 degrees), and that the tools operate at much higher speeds than in conventional practice. The speeds are up to ten times those of high-speed steel cutters, with six times the feed.

Conventional cutters present the weakest point of the cutting tooth to the work, while teeth with negative angles shear the metal off. Thrust is exerted against the bearing, instead of a pulling action against the end-play adjustment collar, as with a positive-angle cutter.

Hyper-mills should have fewer teeth than ordinary milling cutters. The coarse pitch is necessary to provide adequate chip space, be-

# Carbide-Tipped Cutters

By MALCOLM F. JUDKINS
Chief Engineer, Firthite Division
Firth-Sterling Steel Co.

cause at the exceptionally high cutting speed employed, the volume of chips produced in unit time far exceeds that with conventional cutters. The coarse pitch also permits the use of thicker tips and thicker blades, both of which are desirable for the process. Since the cutting force tends to pull the blades out of the cutter body, due to the negative rake, a positive method for locking the blades is desirable. This may be a reverse-angle wedge or a pull-back screw behind each blade.

While the negative angles theoretically trap the chips and obstruct their escape from the region of the cutting point, the extremely high speed and thin chips cause rapid flow across the tooth face.

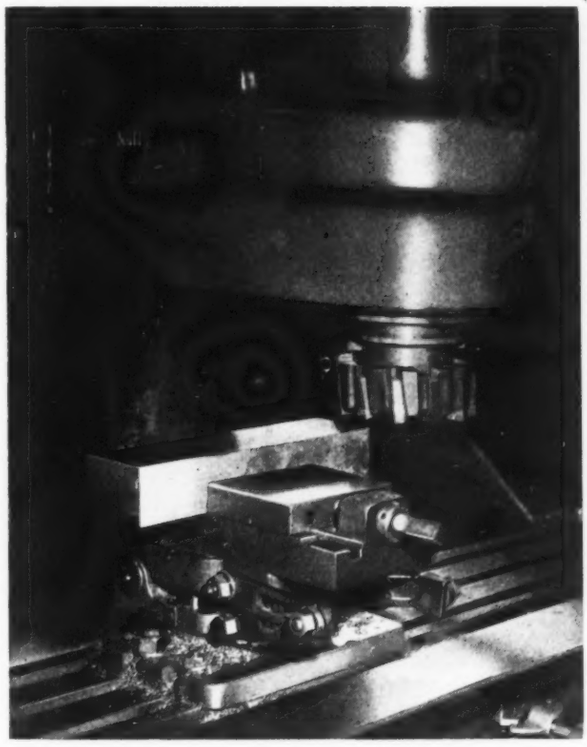
An important factor in the new method is that high speed and light feeds limit the heat generated and the rate of heat transfer, so that the chips dissipate the heat without communicating it to the cutter or to the work in any appreciable degree.

The work done so far indicates that about 400 feet per minute is the minimum cutting speed at which hyper-milling can be performed with Grade T-16 Firthite, which has been used with the greatest success up to the present. The feed per tooth per revolution should not exceed about 0.0015 inch, and the depth of cut should be limited to 1/8 inch or less.

In applying hyper-milling, naturally the best results are obtained with modern machines and specially designed cutters. Older machines can be used, provided the necessary speed is available. Because of the light feed and shallow cut, and the fact that increasing the speed does not increase the cutting pressure, the result is frequently less pressure than formerly.

Frequently a conventional face mill that may be on hand can be used for hyper-milling by removing every other tooth to provide needed chip space and by applying the Firthite tip to the under side of each blade and reversing the rotation of the cutter. Somewhat the same effect can be obtained by merely grinding negative rake and helix on the face of the tooth for a portion of the tip width and length only.

While the production work up to the present time, using Firthite T-16, has been limited to a 1/8-inch maximum depth of cut, it is believed that tougher grades now being tried will extend hyper-milling to heavier cuts.



An Indication of the High Degree of Finish Produced after Making a Cut with a "Hyper" Milling Cutter. Milled Surface is not Retouched

"Hyper Mill" in Action on Annealed Tool Steel at 419 R.P.M., Taking a 1/16-inch Depth of Cut with a Feed of 5 3/4 Inches per Minute

# MATERIALS OF INDUSTRY

## THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

### Phenolic Molding Plastic with High Impact Resistance

A new phenolic molding plastic of high impact resistance, designated Bakelite phenolic resin XM-15000, has recently been placed on the market by the Bakelite Corporation, 30 E. 42nd St., New York City. This product was developed to meet the needs of industry for a molding material having a high impact resistance that can be preformed on automatic tabletting machines.

When molded, this compound has approximately twice the shock resistance of general-purpose phenolics. Its impact strength (ASTM) is 4.8 to 6.3 foot-pounds per square inch. Its water resistance is also good, compared to other shock-resistant phenolic plastics. This plastic is recommended for use in making molded parts that are subjected to temperatures up to 300 degrees F. .....200

### Molybdenum-Manganese Steel Welding Rod Conserves Nickel

A molybdenum-manganese steel welding rod that can be used in place of nickel-manganese steel welding rods has been brought out by the American Manganese Steel Division, American Brake Shoe & Foundry Co., Chicago Heights, Ill. In comparison with nickel-manganese steel rods, tests have shown that these new rods apply as readily and that their deposits have equal or better tensile strength. They can be used to repair fractured manganese-steel castings and also for build-up work on manganese-steel and other ferrous parts. .....201

### Solvent Emulsion Type of Metal Cleaner

A thin-bodied metal cleaner known as "Lixol," of low viscosity, which forms a permanent milk-white emulsion with water and dilutes clear with kerosene, has been placed on the market by the Cowles Detergent Co., 7016 Euclid Ave., Cleveland, Ohio. When used as a water emulsion, suitable for pressure spray washing, it produces physically clean surfaces resistant to rusting. For this purpose, it is maintained at a temperature of 200 degrees F.

When used straight or diluted with kerosene, it can be applied by dipping, slushing, or spraying to remove oil or grease coatings, particularly those containing mill smut, spent abrasives, or other solid dirt. The cold water rinse following its application in this form produces an emulsion that carries off oil and dirt, producing a physically clean surface. .....202

### New Magnesium Bomb and Fire Extinguisher

A new product, known as Cend-Ex, is being marketed by the S. Obermayer Co., 2563 W. 18th St., Chicago, Ill., for use in extinguishing magnesium bombs and fires. Cend-Ex is a granulated coal tar pitch conforming to the standards set by the U. S. Bureau of Mines and recommended as being most effective in dealing with magnesium bombs and fires. It comes packed in 12 1/2-pound rectangular tubes which can be hung on the wall or placed at strategic points in a factory, ready for instant use. The tubes are 30 inches long—thus enabling the operator to keep some distance away from the bomb or fire while applying the granulated coal tar pitch to it.....203

### Sealing Compound for Fuel and Oil Tanks

A compound extruded on a cloth backing, and furnished in roll form for sealing fuel and oil tanks, has been developed by Presstite Engineering Co., 3930 Chouteau Ave., St. Louis, Mo. In application, this cloth-backed compound is pressed on the surface to be sealed and rubbed down tightly, after which the cloth backing is peeled off. This leaves a uniform thickness of the compound on the area to be sealed.

Tests have proved this sealer to be highly adhesive to metal surfaces, even in the presence of liquid hydro-carbons. It does not readily dry



To obtain additional information about materials described on this page, see lower part of page 194.

out or evaporate, is non-oxidizing, non-polymerizing, and highly resistant to aromatic fuel. This compound contains no solvent to evaporate..204

## Synthetic-Resin Coating for Metal Protection

Especially developed as a protective coating for metal surfaces is a synthetic-resin base coating designated "Resi Flex," which is manufactured by the David C. Brown Co., 17532 Wisconsin Ave., Detroit, Mich. This coating is said to be waterproof, oilproof, and impervious to mineral acids, alcohols, and gasoline. It is furnished in a water-clear solution. Application is by dipping, brushing, or spraying. After application, the finish is baked on for a period of six to thirty minutes at a temperature of 275 to 300 degrees F., depending upon the size of the unit and the type of material. .....205

## Hard-Facing Rods Developed to Meet "Low-Priority" Needs

Two hard-facing alloys — "Stoodite K" and "Stoody Self-Hardening K," have been developed by the Stoody Co., Whittier, Calif., for companies unable to furnish high-priority ratings.

Stoodite K is a cast hard-facing rod consisting principally of molybdenum, tungsten, manganese, silicon, carbon, and iron. It is supplied both in bare form for oxy-acetylene application, and in coated form for direct-current electric application. Deposits of Stoodite K average 54 to 58 on the Rockwell C scale, depending on the type of parent metal and the method of application. They are smooth, dense, and free from porosity and shrinkage cracks. These deposits will withstand considerable pressure and impact if properly supported, and are said to offer excellent resistance to all types of abrasive wear.

Stoodite K is recommended for hard-facing various types of agricultural tools, cement-mill parts, brick and clay equipment, dredging and excavating equipment, etc.

Stoody Self-Hardening K is composed principally of molybdenum, manganese, silicon, carbon, vanadium, and iron, and is made in the form of tubes with the mixed alloys on the inside. This rod is supplied bare for oxy-acetylene application, and bare and coated for direct-current electric application. Deposits average 50-54 on the Rockwell C scale, depending on the type of parent metal and the method of application. In addition to being highly resistant to wear, this alloy will also withstand considerable impact if properly supported. It forms an excellent bond with manganese steel, and can be used for hard-facing various types of manganese equipment. Deposits can be forged, provided forging is done at red heat.

Stoody Self-Hardening K is recommended for hard-facing tractor parts, sheepsfoot tamper shoes, roll crushers, jaw crushers, gyratory crusher heads, conveyor buckets, dredge pump impellers, and other equipment subjected to both severe wear and impact.

Both Stoodite K and Stoody Self-Hardening K are available under the regular A-10, P-100 rating, and are being distributed by Air Reduction Sales Co., 60 E. 42nd St., New York City. .....206

## Practical Substitutes for Tin-Base Babbitts

Two new lead-base bearing metals, known as "Pyramid" and "Defender," have been developed by the Magnolia Metal Co., 120 Bayway, Elizabeth, N. J., as substitutes for tin-base babbitts, which are now so difficult to secure.

Pyramid Metal is well suited to applications where bearings must withstand heavy sustained pressures, such as are in marine reciprocating engines, water turbines, paper mill calender stacks, and rolling mill machinery. Defender Metal stands shocks without cracking, and is well suited for use in internal combustion engines, trap rock crushers, and sifter machinery. .....207

## Compound Prevents Adherence of Weld Spatter

The Acme White Lead & Color Works, Detroit, Mich., have developed a compound called "Industrial Finish Flash-Off No. 99" to prevent the adherence of weld spatter to parts being welded together. In use, the compound is brushed, sprayed, or wiped along the surfaces adjacent to the parts to be joined by the weld. During the welding operation, the metal spatter bounces or falls off instead of adhering to these areas. This eliminates the necessity of performing grinding or scratching operations to remove the spatter. The seam is smoother, and it is also claimed that a stronger joint results, since Industrial Finish Flash-Off removes impurities from the weld, and, being an excellent conductor of electricity, helps to prevent the welding arc from breaking.

An additional feature of the new product is its cleansing effect, which prevents pitting on galvanized or ungalvanized metal surfaces and permits the immediate application of paint without any other cleaning operation than that of wiping off. .....208

To obtain additional information about materials described on this page, see lower part of page 194.

## A Wiring "Jig" for Resistance-Welder Controls

At the plant of the General Electric Co. in Schenectady, N. Y., where many Thyratron resistance welder controls are being made for the precise control of resistance welding machines, the quantity production of these controls is greatly aided by pasting oil-resistant paper wiring templets to the back of the panels. This arrangement simplifies the drilling of holes in the panel and speeds up the assembly by indicating exactly where all parts are to be placed on the panel board.

The accompanying illustration shows one of these panels being assembled. To the left is the panel as it comes from the drilling operation. All the workman has to do is to fasten the many parts in their respective places, and connect the wires as indicated on the templet drawing. The worker can leave the panel temporarily and take up the assembly later without trying to memorize all that he has done previously; or someone else can take over the work without further instructions. When completed, the assembly and wiring can be checked almost at a glance.

In addition to speeding production, this arrangement helps to simplify the maintenance job at the plant where the control is installed, since the templet is left in place on the panel. The method described suggests how similar "jigs" may be provided for much work where now elaborate laying-out methods are used for each separate piece, with much waste of time.

## Machine Tool Builders Receive Army-Navy Production Award

On August 20, the Army-Navy Production Award was presented to the management and the employes of the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. The ceremonies took place inside the Pratt & Whitney plant.

On the same day, the Army-Navy Production Award was presented to the management and employes of the Simmons Machine Tool Corporation, of Albany, N. Y.

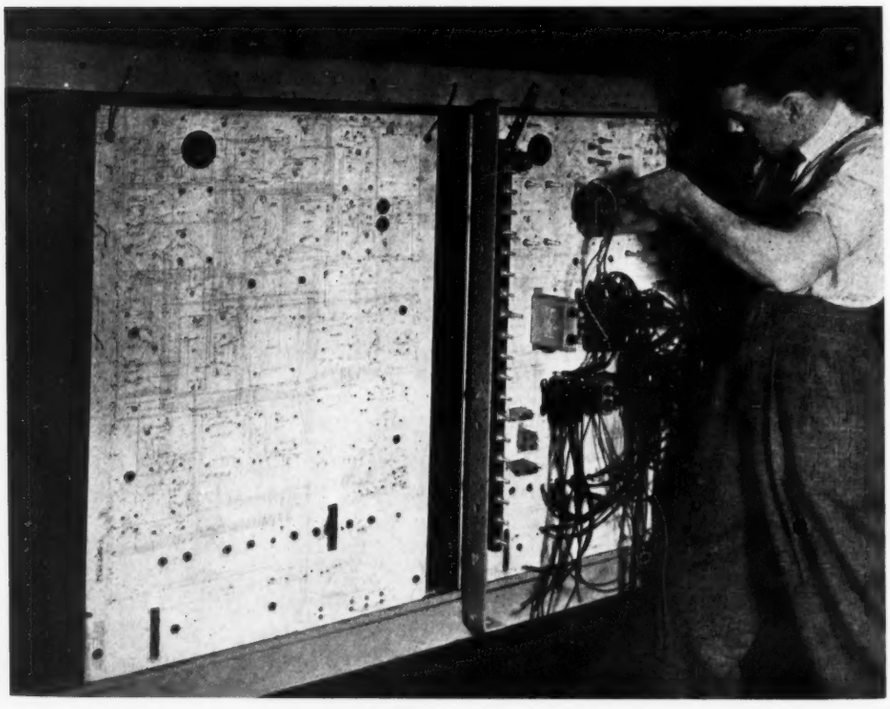
On August 21, the Award was presented to the management and employes of the Landis Tool Co., Waynesboro, Pa., for "excellence in production."

On August 22, the Gleason Works, Rochester, N. Y., received the Production Award. The presentation ceremonies took place at the Eastman Theater in Rochester.

Monday, August 24, presentation ceremonies took place at the plant of the Bullard Co., Bridgeport, Conn., when the Bullard organization received the Production Award for "high achievement in the production of war equipment."

* * *

An unusual case of conversion to war work is that of a large plate-glass company, which, under a sub-contract from the Westinghouse Electric & Mfg. Co., is now producing steel turbine spindle shafts for naval vessels.



Paper Wiring Templets Used in the General Electric Co.'s Plant for Resistance Welding Machine Control Boards

## "Suttonizing," A New Process for Reclaiming High-Speed Steel Tools

The need for conserving all high-speed steel tools is well understood throughout the machinery and war-equipment manufacturing industries. The difficulty of obtaining any of the high-speed steels has made everyone in the mechanical industries fully cognizant of this. Any method, therefore, by means of which high-speed steel tools can be reclaimed or repaired is of great importance at this time.

A welding process known as "Suttonizing," to be used for the reclamation of high-speed steel tools, has been developed by Thomas Sutton, welding engineer of the Welding Equipment & Supply Co. By means of this process, repairs can be made of fractures and of the teeth, flutes, tangs, and shanks of all kinds of cutting tools, including milling cutters, broaches, drills, end-mills, reamers, forming tools, and cutting tools for lathes, planers, and shapers.

The Suttonizing method differs from others frequently used for this purpose in that subsequent heat-treatment of the repaired tools is not usually necessary. Neither is it necessary to anneal the tools before making the repairs. The alloys added by the welding process become integral parts of the tools. In the research work incident to the development of the Suttonizing method, considerable thought was given to the production of the proper welding rod to be employed.

Furthermore, it is stated that Suttonizing provides a means of combining the cutting qualities of ordinary high-speed steel with the abrasive resistant qualities of tungsten carbides; yet there is no difficulty in grinding the tools, since the deposits are as easy to grind as ordinary high-speed steel. The welding rod used in the new process is said to give deposits that are homogeneous and that will equal or excel the original hardness of the tool being repaired.

The Welding Equipment & Supply Co., 223 Leib St., Detroit, Mich., is in a position to handle reclamation or repairs to tools sent to the company, and to give any further information about the process that may be required.

* * *

## Improved M & L Tapping Machine—Correction

The M & L tapping machine, described and illustrated on page 176 of the August number of MACHINERY, is manufactured by the Leckinger Machine & Experimental Co., Los Angeles, Calif., instead of by the Brand Tool & Supply Co., as incorrectly stated. The latter company serves only as the distributor for this machine.

## New Line of Standardized Carboloy Boring Tools

A complete standardized line of Carboloy boring tools has been brought out by the Carboloy Company, Inc., 11147 Eight-Mile Boulevard, Detroit, Mich., to supplement the standard line of Carboloy facing and turning tools. These standardized boring tools are made in sizes ranging from 3/32 to 1/4 inch in diameter in the solid Carboloy type, and in diameters ranging from 5/16 to 1/2 inch in the tipped types. Both types will be furnished cylindrically ground to a tolerance of plus 0.000, minus 0.001 inch, with the cutting edges unground. This permits the user to grind the cutting edges to suit specific work.

The line comprises six sizes of solid Carboloy boring bits and four sizes of tipped tools, each of the latter being available in the two styles. Tipped tools have a shank length of 2 inches for the 5/16- and 3/8-inch sizes, while larger sizes have shanks 2 1/2 inches in length.

* * *

## National Emergency Steels Available from Stock

Peter A. Frasse & Co., Inc., 17 Grand St., New York City, has added two National Emergency Steels in both hot and cold finishes to its stocks in New York, Philadelphia, and Buffalo. These grades — NE 8620 and NE 8739 — are available in the following size ranges:

NE 8620 (carburizing type): Hot-rolled, from 5/8 inch to 8 inches round; cold-drawn, from 1/4 inch to 2 inches round; cold-drawn, from 7/16 to 1 inch hexagon.

NE 8739 (hardening type): Hot-rolled, from 1/2 inch to 8 inches round; cold-drawn, from 1/4 inch to 2 1/2 inches round; cold-drawn, from 5/16 to 1 inch hexagon.

Both of these steels are recommended by the War Production Board as substitutes for higher alloy grades which may become unavailable in the future. Users of these emergency grades are requested to report their heat-treating and fabricating experiences to the Board.

* * *

According to recently collected statistics, 4 per cent of all men and 0.5 per cent of all women are color-blind. In many occupations, this is a dangerous condition, and for that reason, the American Optical Co., Southbridge, Mass., has developed a color-perception test, especially devised for industrial use because of its ease of operation and universal application. The test material consists of forty-six test plates. An instruction handbook accompanies each test set.

# NEW TRADE LITERATURE

## RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

*To Obtain Copies, Fill in on Form at Bottom of Page 193 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September Number of MACHINERY*

### Steel

UNION DRAWN STEEL DIVISION OF REPUBLIC STEEL CORPORATION, Massillon, Ohio. Steel Handbook No. 42 for machine tool users. This 84-page handbook contains much information, primarily for those who operate and plan work for automatic screw machines, but also for others interested in the machining of steel. ..... 1

### Machine Tools and Shop Equipment

DELTA MFG. CO., 606-K E. Vienna Ave., Milwaukee, Wis. Booklet showing adaptations of Delta machines in many branches of the armament program, including drill presses, grinders, cutting-off machines, abrasive finishing machines, and scroll and band saws. ..... 2

### Inspection and Assembling Equipment

BOYER-CAMPBELL CO., 6540 Antoine St., Detroit, Mich. Bulletin entitled "Super Sight Magnification and Light Where You Want It," illustrating and describing devices for close inspection, fine assembly, and precision machining. ..... 3

### Mechanics' Tools

AMERICAN SWISS FILE & TOOL CO., 410-416 Trumbull St., Elizabeth, N. J. Catalogue entitled "American Swiss Mechanics' Tools," listing more than five hundred different types and sizes of punches, chisels, drills, socket wrenches, and other mechanics' tools. ..... 4

### Screw Products

MANUFACTURERS SCREW PRODUCTS, 294J W. Hubbard St., Chicago, Ill. Screw products catalogue (96 pages) in which all items conform to the revised suggested stock size-lists of the Office of Price Administration. ..... 5

### Lubrication of Machine Tools

CINCINNATI MILLING MACHINE CO. AND CINCINNATI GRINDERS INCORPORATED, Cincinnati, Ohio. Publication M-1084 (52 pages), on lubrication of Cincinnati milling, grinding, broaching, and lapping machines. ..... 6

### Quench Coolers

YORK ICE MACHINERY CORPORATION, York, Pa. Catalogue entitled "If You Heat-Treat, You Need York Quench Coolers," describing the features of the York evaporative liquid cooler, and giving dimensions of the various models. 7

### Machine Tools and Cutting Tools

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit, Mich. Bulletin 27121, covering the company's entire line of precision machine tools, cutting tools, and related products. ..... 8

### Sheet-Metal Specialties

WALTERS MFG. CO., Oakmont, Pa. Folder describing the manufacturing facilities of the company for making large and small sheet-metal specialties, including the required welding and riveting operations. ..... 9

### Manganese-Steel Chain

AMERICAN MANGANESE STEEL DIVISION OF THE AMERICAN BRAKE SHOE & FOUNDRY CO., 389 E. 14th St., Chicago Heights, Ill. Bulletin 742-CN, on manganese-steel chain for elevating and conveying. ..... 10

### Ampco Metal in Aircraft

AMPCO METAL, INC., Milwaukee, Wis. Engineering Data Sheet No. 103, descriptive of the design features of Aeroprop propellers for airplanes and the use of Ampco Metal in their construction. ..... 11

### Flexible Power Presses

GENERAL MFG. CO., Detroit, Mich. Bulletin 367, describing the construction and operation of the General 8-ton flexible power press, designed for straightening, bending, and other press operations. ..... 12

### Fan Motors

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular GEA-3684A, illustrating and describing fractional-H.P. fan motors for air-conditioning systems, refrigeration equipment, exhaust fans, etc. ..... 13

### Steel

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. 32-page book "Tool Steel for the Non-Metallurgist." Bulletin entitled "Cold-Rolled and Cold-Drawn Specialty Steels." ..... 14

### Welding Electrodes

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Bulletin consisting of a series of shop posters entitled "Help Win the War—Save Materials—Don't Waste Electrodes." ..... 15

### Manufacture of Plastics

DUREZ PLASTICS & CHEMICALS, INC., North Tonawanda, N. Y. Booklet illustrating and describing the manufacture of plastics, from the raw materials to the finished products. ..... 16

### Speed Reducers

WINFIELD H. SMITH, INC., Springville, Erie County, N. Y. Bulletins pertaining to speed reducers, entitled "Torque versus Horsepower" and "Overhung Loads on Speed Reducer Shafts." ..... 17

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### Salt Baths for Heat-Treatment

E. I. DU PONT DE NEMOURS & CO., INC., Wilmington, Del. Manual of 72 pages, 8 1/2 by 11 inches, covering molten salt baths for the heat-treatment and casehardening of steel. ..... 19

### Automatic Control of Synthetic Rubber Processes

BRISTOL CO., Waterbury, Conn. Bulletin 103, giving information on the application of automatic control instruments for synthetic rubber processes. ..... 20

### Tool Control Machines

OHMER REGISTER CO., Dayton, Ohio. Bulletin A697, descriptive of the Ohmer tool control machine for use in making a record of tools that are issued by tool-cribs to employes. ..... 21

### Voltage Regulators

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-3080, containing a summary of the features of the Westinghouse Type SA air-cooled induction feeder regulator. ..... 22

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ANDREW C. CAMPBELL DIVISION, AMERICAN CHAIN & CABLE CO., INC., Bridgeport, Conn. Booklet describing the Model 425 Cutalator abrasive cutting machine. ..... 23

### Self-Locking Nuts

ELASTIC STOP NUT CORPORATION, 2332 Vauxhall Road, Union, N. J. Wall chart explaining the uses of the various types of self-locking nuts made by this concern. ..... 24

### Reconditioning of Taps

DETROIT TAP & TOOL CO., 8432 Butler St., Detroit, Mich. Wall chart giving instructions on sharpening various types of threading taps. ..... 25

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O'NEIL-IRWIN MFG. CO., Minneapolis, Minn. Catalogue 42-2, illustrating and describing the Di-Acro system of metal duplicating without dies. ..... 31

### Plastic Tubing and Fittings

ELMER E. MILLS CORPORATION, 812 W. Van Buren St., Chicago, Ill. Catalogue of plastic tubing and fittings, giving technical data and physical properties. ..... 32

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PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit, Mich. Bulletin 801M, covering the company's new line of standardized seam-welding machines. ..... 38

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BOWER ROLLER BEARING CO., Detroit, Mich. Circular entitled "Keep 'em Flying," illustrating and describing the features of Bower roller bearings. ..... 39

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BARCUS ENGINEERING CO., 3931 Falls Road, Baltimore, Md. Bulletin on aligning shaft couplings. 50

### Filters

FILTERS, INC., 1515 Gardena Ave., Glendale, Calif. Folder on compressed air filters. ..... 50-A

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# *Shop Equipment News*

***Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market***

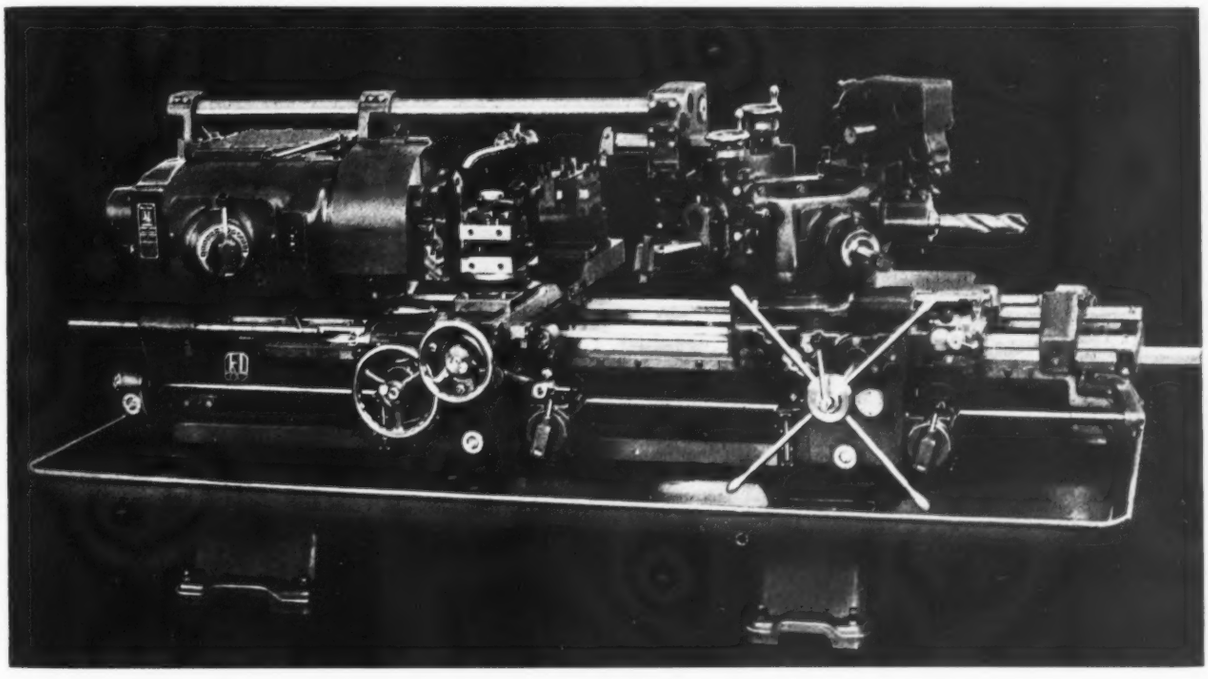
## Jones & Lamson Universal Saddle Type Turret Lathes

The Jones & Lamson Machine Co., Springfield, Vt., has just placed in production its new 9A and 10A saddle type universal turret lathes. The 9A machine has a maximum round-bar capacity of 3 1/2 inches and swings 23 1/2 inches over the way covers, while the 10A machine has a maximum round-bar capacity of 5 inches and swings 27 1/2 inches over the way covers.

These machines have passed through a long testing period and embody all the labor- and time-saving features of previous turret lathes built by this company. Important features are power traverse of the saddle and power indexing of the hexagonal turret, both operated by one lever through which both high and low positive traverse speeds can be obtained. Additional support for the multiple turret heads is furnished by a heavy stationary pilot-bar mounted on the headstock. The heavy-duty headstock is provided with anti-friction transmission and spindle bearings throughout.

Another important feature is the massive double-wall box-ribbed design of the bed. The width across the ways of the smaller machine is 17 inches, and across the larger, 20 inches. The built-in power rapid traverse for the bridge type carriage and cross-slide is another improved feature of these machines. The power rapid traverse has an all-geared drive, and is operated by a single lever through which all four movements of the carriage and cross-slide, or a combination of these movements, can be obtained. This feature is said to be responsible for a substantial increase in production, and eliminates much tiresome hand-cranking. It also permits multiple tooling on both front and rear of the cross-slide to be used as advantageously as possible.

Single-lever speed and feed selectors, coolant supply under pressure directly to the working face of the hexagonal turret, and other labor-saving features are included in the new models. The bar-feed mechan-



Jones & Lamson 9A Saddle Type Universal Turret Lathe with Chucking Equipment

To obtain additional information on equipment described on this page, see lower part of page 194.

ism is power-operated. A reversible torque motor, controlled by an electric switch within easy reach of the operator, actuates the stock-feed chuck lead-screw through a gear train for advancing or withdrawing the stock as required for the machining operations. 51

## Stamets Bomb Boring, Facing, and Tapping Machine

**Approved for Publication by the War Department**

William K. Stamets, Pittsburgh, Pa., has just brought out a machine for performing boring, facing, and tapping operations on both ends of bombs ranging in size from 100 to 1000 pounds. The machining can be done in one chucking, and the machines are furnished for performing the operations specified on one size of bomb. The machines can be modified to take bombs of any other size within their range.

The new machine consists essentially of a bed which supports a center-driven chuck rotating in plain bearings, a rotating center-rest mounted in anti-friction bearings, and a turret carriage on each side of the chuck. Since there is but one axis of rotation, concentricity of the finished ends is assured. The carriages are fed by lead-screws driven from the chuck, and can be connected by clutches to the motor for rapid traverse. Hand-feed is obtained by rotating the nut around the screw by means of a handwheel.

The right-hand turret carries a boring-bar with facing tools at one or two stations and a collapsible tap at another station. The left-hand turret is equipped with a motor-driven drill unit, a boring-bar with facing tools, an under-cutting tool when required, and a tap. All tools are supported in guide bushings close to the operating point. Adjustment for possible variation in the bomb length is provided.

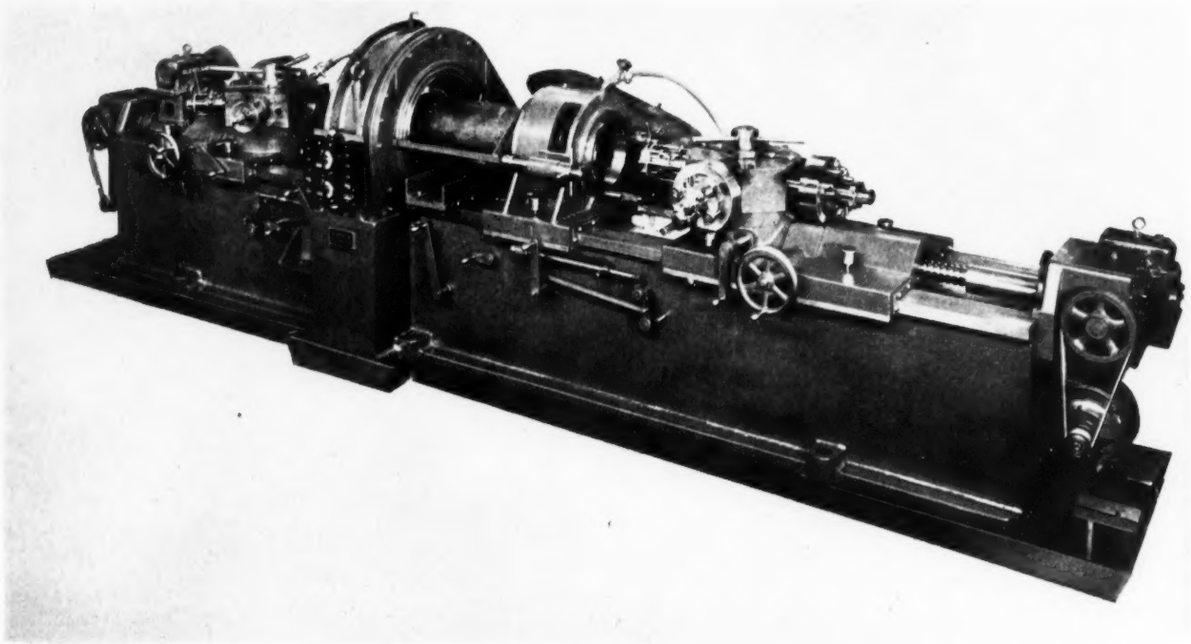
The bomb is brought to the machine on a conveyor, and can be rolled into place on a bridge rail and chucked. The closed end of the bomb is forced against a driving ring in the chuck by pressure of the rotating center-rest. After both ends have been machined, the rapid traverse movement of the rotating center-rest is employed to remove the bomb from the chuck. The bomb is then rolled to the rear of the machine where a fixture tilts it to permit the cutting oil to drain off. During the draining operation, the next bomb is chucked and machining started, after which the completed bomb is transferred to a conveyor at the rear of the machine. 52

## Kent-Owens Vertical Miller

To meet the increasing demands for production-line methods, the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio, has brought out a No. 1-14V vertical milling machine designed especially for rapidly performing vertical milling operations on small parts. This machine has a simple stepless, adjustable, hydraulic table feed arranged for full-automatic cycle operation. Table movements are obtained by a control lever which automatically indicates the direction of the table movement. Graduated dials, also with stepless adjustment, provide any feed rate within the entire range of from 1 to 40 inches per minute.

The table can be fed in either direction, and has rapid traverse in both directions. Provision is made for automatic shifting from rapid traverse to the feeding rate in either direction, and automatic reversal at both ends of the stroke. Hence, practically any desired cycle of operations can be obtained, such as milling work at one end of the table while loading or unloading work at the other end. Dogs can also be provided for use in performing intermittent milling.

This floor type machine has a box type bed which completely encloses the motor and hydraulic pump unit that actuates the table. The spindle head has crosswise



Stamets Double-end Turret Machine for Boring, Facing, and Tapping Both Ends of Bombs in One Chucking



To obtain additional information on equipment described on this page, see lower part of page 194.

adjustment by means of a screw and micrometer dial. The head carriage is adjustable vertically on two ground cylindrical steel posts by a screw equipped with a micrometer dial. This design provides unusual rigidity, as the work and cutter are closely coupled, regardless of the size of the work.

Ten spindle speeds ranging from 115 to 300 R.P.M. are quickly available. There are no gears in the spindle drive, this drive being entirely by V-belts from the standard foot-mounted motor on the rear of the spindle head. Interchangeable V-belt pulleys are used, with an intermediate adjustable pulley for providing full speed range and for keeping the belts in proper tension. Spindle speed changes are made simply by raising the hinged cover on the spindle head and setting the V-belts.

This machine can be equipped with either a one- or a two-way positive stop with dwell. With this arrangement, the work is fed into the cutter to a fixed positive stop. The work dwells at this position momentarily while the cut is completed, and then is automatically withdrawn from the cutter. A switch is available for disengaging the positive stop. ..... 53

## General Electric Welding Transformer and Crater Filler

A new line of heavy-duty alternating-current welding transformers especially designed for Unionmelt welding has been brought out by the General Electric Co., Schenectady, N. Y. This equipment is available in 750- and 1000-ampere sizes for 220-, 440-, and 550-volt power. Built-in capacitors and primary control are features developed to improve voltage regulation and to simplify wiring in portable installations. A disconnecting switch and auxiliary transformer are provided to furnish power for the operation of Unionmelt auxiliary equipment.

Motor-operated remote adjustment permits an operator to make current adjustments without leaving the work. Fan-cooling is employed to save materials and space. Ample ventilation permits two welders to be mounted side by side without requiring extra space between them for ventilating air. The current output of each welding transformer is indicated by a large accurately calibrated scale at the front of the housing.

A crater filler for use with the G-E Strikeasy arc welder is another new development of the General Electric Co. The crater filler, which serves as a foot accelerator for welders, is designed to provide the very close auxiliary control of heat required in welding thin material, such as aircraft tubing, and to permit tapering off of the welding current at the end of a bead in order to fill the crater which is otherwise left.

Fig. 2. G-E Crater Filler for Strikeasy Arc Welder

The crater filler is essentially a combination of a foot-operated rheostat for reducing the current and a field forcing switch for providing a "hot" start or an increase in welding current when required. It is not intended to replace the control on the Strikeasy welder,

Kent-Owens Vertical Miller Designed for Milling Small Parts Rapidly

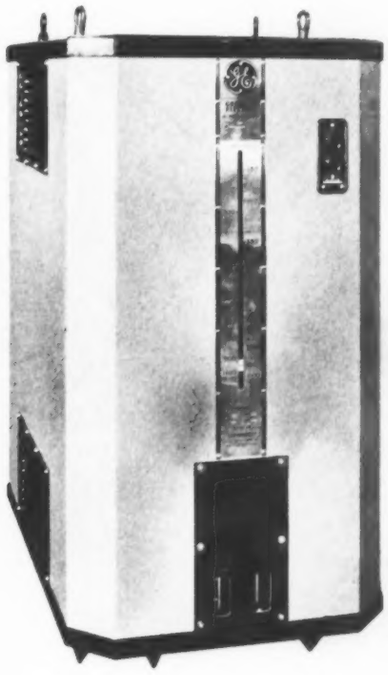
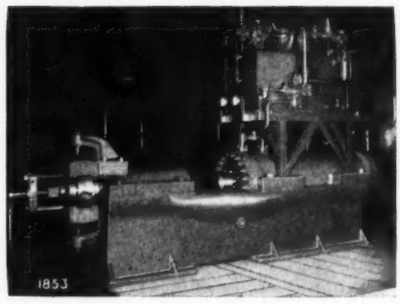


Fig. 1. General Electric Heavy-duty Arc-welding Transformer

To obtain additional information on equipment described on this page, see lower part of page 194.

but for increasing or decreasing the heat setting to accommodate abnormal conditions at the beginning or end of a weld or during the welding operation. Adjustment for normal welding heats is made in the usual way. When the arc is broken, the crater filler permits either a rapid or a slow decrease in current down to the point where the arc is extinguished. This assists the operator in finishing a bead without the production of a crater, since he can vary the rate of current fading to suit the conditions of each particular weld. The crater filler is particularly useful in working with thin material when normal welding heats are low, since, under these conditions, it provides the momentary increase in heat often desired. ..... 54




Beatty Improved Hydraulic Extruding Press

## Pines Profiler with Automatic Feed

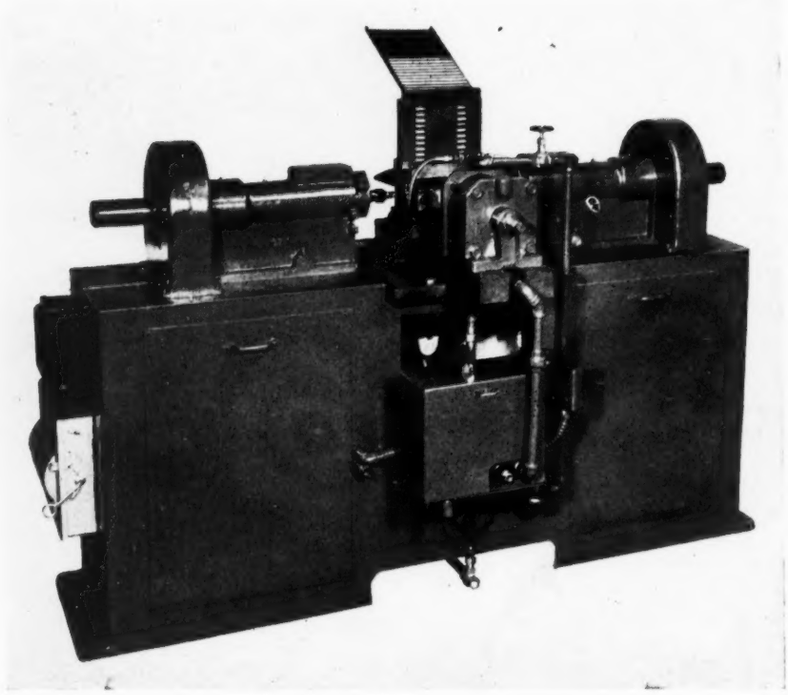
**Approved for Publication by the War Department**

The two-spindle profiling machine made by the Pines Engineering Co., Inc., Aurora, Ill., is now being equipped with an automatic chute feed to the air chuck. This attachment is employed for feeding such parts as brass and copper primer tubes to the machine for performing boring and tapping operations on both ends simultaneously. It is claimed that the production of the machine has been increased as much as 30 per cent by the addition of the automatic feed under certain conditions.

This profiler is being employed on such defense work as burring, chamfering, facing, threading, centering, reaming, and boring both ends of tubes or rods simultaneously for bombs, tank tread tubes and pins, etc. Several profiling operations can be combined and performed simultaneously, thus increasing production. ..... 55

## Harnischfeger 1-Ton Hoist

A 2000-pound model of the Zip-Lift type of hoist has recently been added to the line manufactured by the Harnischfeger Corporation, Milwaukee, Wis. This model rounds out the line of hoists of the Zip-Lift type of 250, 500, and 1000 pounds capacity. It is equipped with the same features as the smaller models, including full magnetic push-button control, preformed non-spinning hoist cables, three-way interchangeable mountings, safety type limit switch, and double brakes. The hoist is of fully enclosed design. 56



Pines Profiler with Automatic Feed to Air-operated Chuck

## Beatty Extruding Press

The Beatty Machine & Mfg. Co., Hammond, Ind., has brought out an improved model No. 100 hydraulic extruding press with a duplex pumping unit which provides for rapid movement of the plunger on the advance and return strokes. A variable-speed control serves to feed material at the rate required for the extrusion of electrodes of various sizes.

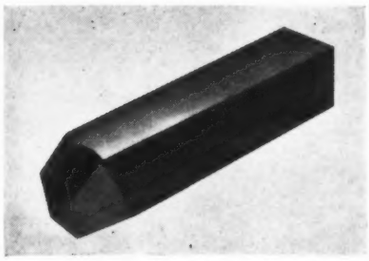
The cylinder that contains the material to be extruded is of cast steel, and has a renewable heat-treated, pressure-tight, iron liner. The press is designed to give a working pressure of 10,000 pounds per square inch on the electrode coating material. Manual adjustment permits pressure and velocity changes to be made easily as required. Duplicate heads can be used alternately by removing the coupling pin, thus eliminating lost time in renewing packing. Material cylinders 50 inches long are regularly furnished, but the machine can be arranged for cylinders 72 inches long to provide space for three 16-inch slugs. ..... 57

## "Armorarc" Electrode for Heavy Welding

A new armor-plate welding rod, 1/2 inch in diameter by 28 inches long, which, it is claimed, will reduce the time for many welding operations to one-quarter of that previously required, has been brought out by the Alloy Rods Co., York, Pa. This welding rod, known as the "Armorarc," is said to be the largest made. It is also produced in smaller sizes down to 1/8 inch in diameter. Rods 5/16 inch in diameter and larger can be used on both alternating- and direct-current welders. ..... 58



**To obtain additional information on equipment described on this page, see lower part of page 194.**



Carboloy Shear Type Tool for Machining Steel Parts Requiring Interrupted Cuts

## Carboloy Shear Type Tools Designed for Interrupted Cuts

Carboloy shear type tools, designed primarily to facilitate the machining of steel parts requiring interrupted cuts, have been brought out by the Carboloy Company, Inc., 11147 8-Mile Boulevard, Detroit, Mich. These tools have been standardized to simplify their production and use. They are characterized by a large negative back rake, which results in a shaving form of cut when used for turning or facing. Thus, when the tool is used for interrupted cuts, the impact load does not come at the end of the tool tip, but farther back along the edge.

The entry of the cutting edge of the tool into the metal after each interruption is gradual, starting at the point of contact back from the tip and working forward to the tip.

These tools have been in use for some time, particularly in the machining of the newer tough alloy steels, and sufficient experience has been accumulated to permit standardizing the various shapes and dimensions. The line includes four basic sizes in both left- and right-hand styles, making a total of eight types. Shank sizes include 1 by 1, 1 1/4 by 1 1/4, 1 1/2 by 1 1/2, and 1 1/2 by 2 inches. The blanks for the standard shear type tools of this new line are of special design.

All tools have a negative back rake of 40 degrees, and are finish-ground on all the angles. The rear corner of the tip projects slightly above the top of the shank. This permits the use of a tip that is thick enough to provide for a maximum number of resharpenings, and yet insures a shank of adequate thickness to support the tool. ..... 59

## Hopper-Fed Automatic Primer-Body Threading Machine

**Approved for Publication by the War Department**

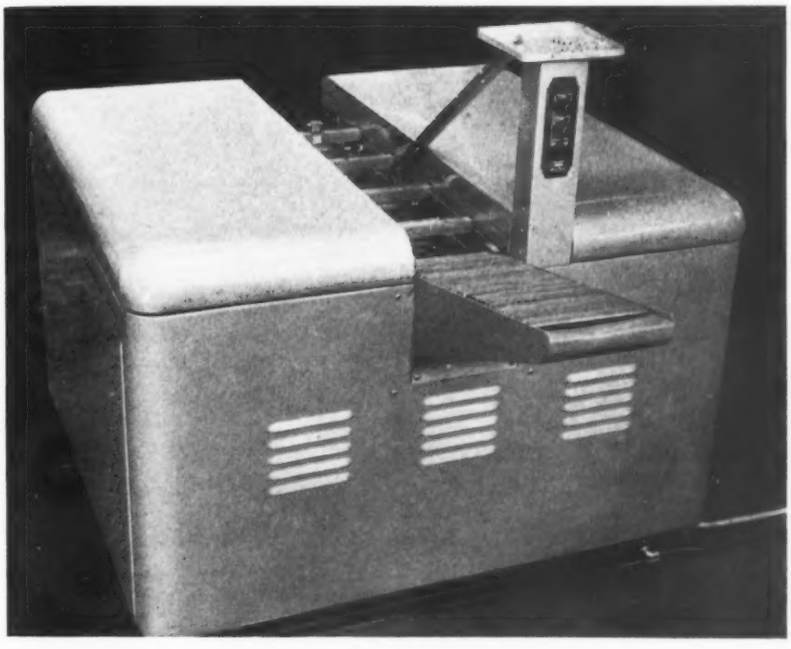
The Watcher Design Co., Cincinnati, Ohio, has brought out an automatic machine for use in the production of brass bodies for percussion primers which are threaded in both ends. This machine is suitable for handling several lengths of work up to 10 inches, and can be employed in making other products. The work can be moved and rechucked for various operations by any number of spindles. In actual test runs these machines have produced several hundred thousand accurately finished pieces.

In making primer bodies, the cut-to-length tubing is fed into a hopper at the front of the machine, and the finished part rolls out at the rear. Both ends of the work are faced, counterbored, reamed, and tapped. A plug is automatically fed into position from a magazine and screwed in and locked by spinning.

The work-carriage has extra open stations which permit rapid removal of a piece after any particular operation for inspection and substitution of an inspected tube. This inspection can be made in less than five seconds. Electric gages are used to check the work, and serve to stop the machine if the plug is not inserted or screwed in to the proper depth. The piece can then be reclaimed and replaced in the machine, thus preventing it from being ruined by the spinning-over operation.

There are several relief and safety devices, including a general system which contacts and protects the work throughout its traverse and applies a motor brake for instant stopping of the machine. The chips and oil are blown from the tube before the plug is screwed in, thus reducing contamination of the degreaser solvent used later for cleaning. A pump system is provided for supplying all tools with oil.

The six spindles and spindle pulleys, including the automatic screwdriver attachment, run on ball bearings and are driven by individual motors and V-belts. The tools have fine adjustment and individual cams which graduate the feed to suit the metal-removal rate or the lead for threading. Springs are used to minimize the effect of backlash in the spindle movement. The machine is supplied complete with motors and tools ready to run. It requires a floor space of approximately 5 by 5 feet. ..... 60



Machine with Hopper Feed for Automatically Threading Primer Bodies

To obtain additional information on equipment described on this page, see lower part of page 194.

## "Hi-Speed" Honing and Lapping Machine

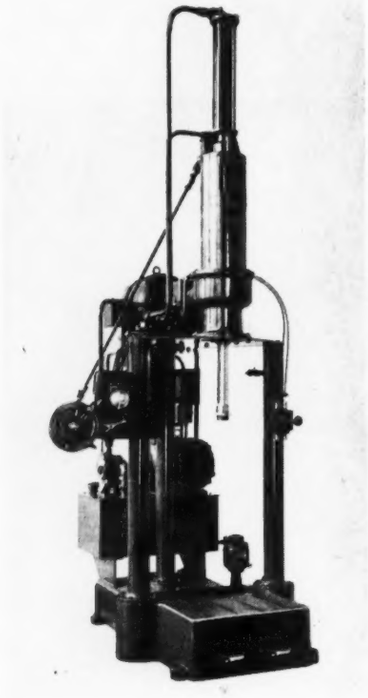
A machine designed for honing cylinders up to 24 inches in diameter, using strokes ranging from 20 to 72 inches in length, has been brought out by the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., North Chicago, Ill. Any standard make of honing head can be employed with this machine to produce accurate straight, round, and smooth bores at a rapid production rate.

This machine is very flexible, both with respect to spindle speeds and reciprocation. It is adapted for handling a wide range of work, such as finishing aircraft cylinders, connecting-rods, all types of internal-combustion engine cylinders, Diesel engine liners, supercharger parts, landing-gear struts, recoil and recuperator cylinders, etc. Hydraulic or pneumatic cylinders, pump or compressor cylinders, air-brake, locomotive, or steam engine cylinders can all be rapidly honed within very close limits. The machine is available in four standard models, any of which can be had with strokes up to 72 inches with any distance under the spindle nose to suit the customer's requirements.

All controls are located at the operator's station in front of the machine. Stroke-setting, withdrawal of the hone, short-stroking at any point, and changes in speed of reciprocation or rotation of the hone spindle can be controlled instantly from the operator's station. A special positive stop and dwell system which makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range, and hold the spindle without reciprocation at that point up to 1 1/2 minutes, can be supplied as extra equipment.

Provision is made for carrying an ample supply of coolant to the hone head to keep the honing stones clean. A large reservoir in the base for the coolant contains multiple settling chambers that are easily accessible.

The working bases of the standard machines range from 21 by 21, to 48 by 54 inches. The heights under the spindle noses with the spindles up range from 48 to 100 inches. The maximum outside diameters of the cylinders that can be accommodated by the four sizes of machines range from 18 to 44 inches. ..... 61

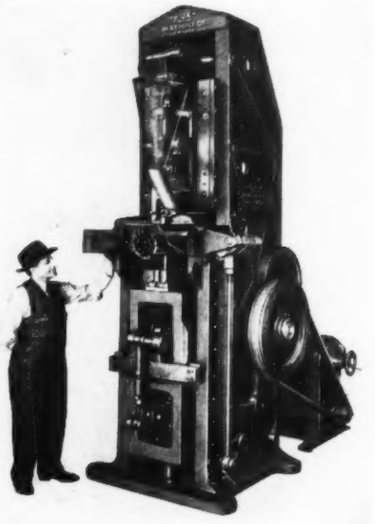


Honing and Lapping Machine Made by Automotive Maintenance Machinery Co.

## Kux Automatic Press

To meet the growing needs of the powdered metal industry, as well as the ceramic industry, the Kux Machine Co., 3930-44 W. Harrison St., Chicago, Ill., has introduced on the market an automatic press—designated Model No. 74—which is one of the largest machines of its type ever built for producing parts from powdered metals and ceramic materials. Oilless bearings, iron gears and cams, metal filters, and metallic electrical contact points are examples of the products formed on this press from powdered iron, bronze, aluminum, platinum, etc. Parts such as radio-tube bases, insulators of all types, coil forms, fuse plugs, etc., are easily and simply made from steatite, porcelain, and other ceramic materials at production rates up to 25 pieces a minute.

This machine permits manufacturing parts of odd, complicated shapes, with cored holes, protruding lugs, and various sectional thicknesses, to very accurate dimensions. It is claimed that pieces made on this machine have uniform structural density throughout, an important requisite of parts formed from both powdered metals and ceramics. Completely automatic in operation, the occasional filling of the supply hopper containing the powdered material is all that is necessary for continuous operation. Up to 50 tons total pressure can be applied by the machine for producing parts having a maximum diameter of 5 inches. The maximum powder cell or die fill is 5 1/2 inches. This machine has a one-piece steel cast main frame which stands 11 feet high. The total weight of the press is approximately 13,500 pounds. ..... 62



Kux Automatic Press for Forming Parts from Powdered-metal and Ceramic Materials

## Tight-End Conveyor Pulleys

A solid type conveyor pulley of rolled-steel construction, which offers important advantages to users of belt conveyors, is a recent development of the American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa. The new pulley, designated Type "N," is made with tight ends that prevent spilled materials, dust, or water from accumulating inside the pulley. It is light in weight and is practically unbreakable. Removable, interchangeable hubs are provided for quick, easy mounting. This pulley is being made at present in diameters ranging from 6 to 36 inches. ..... 63



To obtain additional information on equipment described on this page, see lower part of page 194.

## Machine for Milling Extractor Trunnion Pockets in Gun Breech Rings

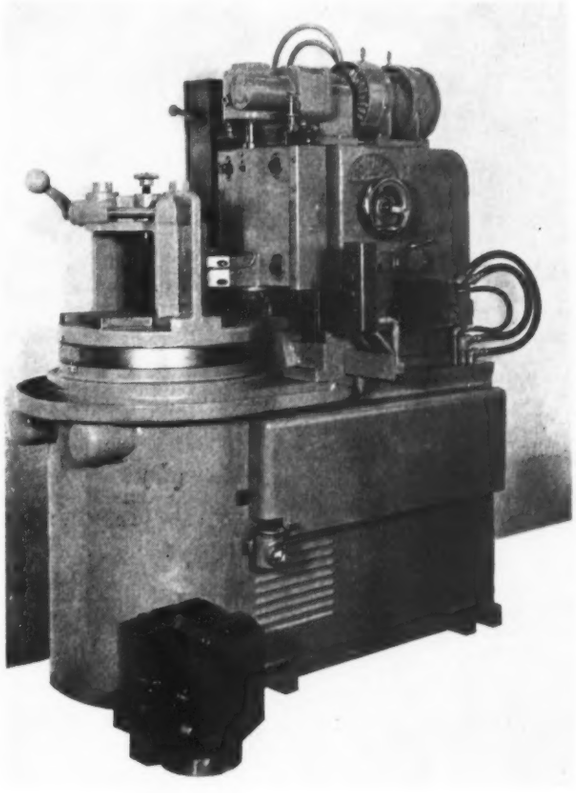
**Approved for Publication by the War Department**

A special machine designed to employ production methods used in automobile plants has been developed by the Snyder Tool & Engineering Co., Detroit, Mich., for milling extractor trunnion pockets in gun breech rings. This operation consists of machining kidney-shaped slots, and is performed without special attachments of the tracer or duplicator type.

The work, shown in the lower left-hand corner of the illustration, is loaded into the locating fixture, and the machine cycle started by pressing a button. The tool-spindle slide advances into position while the fixture table starts to oscillate the work through a short arc which controls the shape of the slot. The slot is cut in steps which are adjustable from a few thousandths inch to 1/32 inch deep per oscillation of the table. The oscillating movement of the table and the tool feed are hydraulically operated and electrically controlled. The hydraulic step-by-step advance mechanism can be disconnected to permit the tool to be fed manually if desired.

The machine consists of three principal sections—the base containing the hydraulic equipment and piping, the rotating table mechanism for the work-holding fixture, and the spindle-head housing with its column and feed mechanism. The two hydraulic plunger cylinders that impart the oscillating movement to the table are enclosed in the welded steel base of the machine. Trip-dogs are provided for adjusting the length of the arc through which the table oscillates.

The work-spindle is driven from an electric motor mounted on top of the base through a pick-off gear drive and spline shaft. The spindle housing in the column assembly is mounted on ways, which permits it to be moved out of the way for loading and unloading. The hydraulic fluid motor and lead-screw mechanism which feeds the tool to the work are contained in the column. The coolant is in a side-mounted trough equipped with a chip basket. ..... 64



Machine Developed by Snyder Tool & Engineering Co., for Producing Slots in Gun Part

## Michigan Gear-Shaving Machine for Finishing Small Gears

The Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., has brought out a new gear-shaving machine (the 861-4B), which is especially designed for the accurate and rapid finishing of gears smaller than 4 inches in diameter and less than 1 inch in face width. It is particularly suitable for the production of gears for instruments, control mechanisms, and similar precision devices in which a high degree of accuracy must be combined with correct tooth form and minimum backlash.


Crossed-axis Gear-shaving Machine for Small Gears

The gear, held on a specially designed mandrel or on its own shaft, is placed between dead centers having hard metal tips. A serrated-tooth rotary cutter, mounted with its axis at an angle to that of the gear, engages and drives the gear first in one direction and then in the opposite direction, for finishing both tooth faces. During the cutting action and in-feed, the cutter also reciprocates across the face of the gear, permitting the use of narrow cutters. Both the cutter cross-feed and the in-feed movement to the correct center distance are cam-controlled. Small gears of such pitches as 32, 48, and 64 have been successfully machined in tests operating on a production basis. The machine is equally adaptable for finishing gears made from stainless steel, carbon steels, and non-ferrous materials. It is about 20 inches deep, 26 inches wide, and 20 inches high. ..... 65

To obtain additional information on equipment described on this page, see lower part of page 194.

## Rogers Vertical Turret Mill

A machine designed for boring, drilling, and turning ferrous and non-ferrous castings, forgings, and other work — designated the "Perfect 36"—has been brought out by the Rogers Machine Works, Inc., 133 Arthur St., Buffalo, N. Y. The specially designed swivel-head and main-head of this machine make it possible to perform two operations on the work at the same time. By incorporating the swivel design in the side-head, quicker and simpler tool setting for irregular pieces is made possible, since the side-head can be set to any angle up to 35 degrees in either direction. The built-in graduated dial saves time in making set-ups for first- and second-run work. The large bearing area of the tool-holder and side-rail, combined with positive clamping means, assures rigidity and accuracy.

The horizontal chuck is located at table level to allow the work to be slid easily and quickly into position, thus eliminating the usual difficulty and awkwardness experienced in clamping heavy work in the chuck. A motor-driven rapid-traverse main clutch that runs in an oil-tight case, convenient foot controls, and a strong rigid frame are features of this machine. The machine has a capacity for handling work 36 inches in diameter. The distance between the table face and the turret face is variable from 0 to 24 inches. Both the main-head and the side-head have eight vertical and horizontal feeds. Any one of eight speeds can be employed. A screw-cutting attachment is available. ..... 66

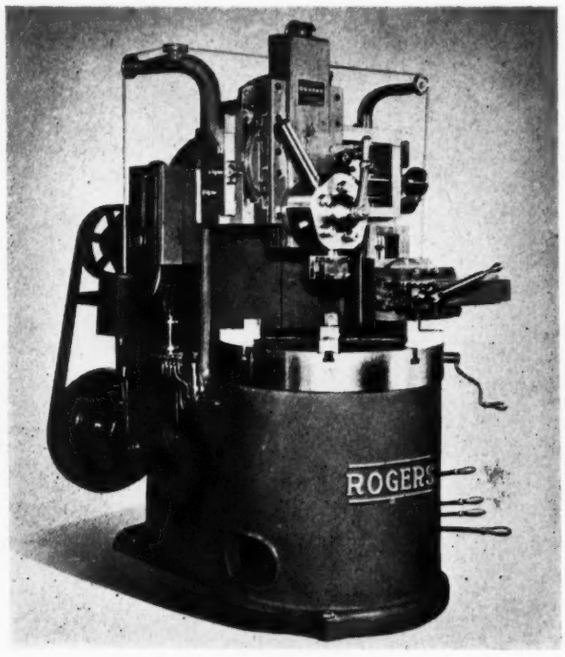
## "Cut-Aid," A New Cutting Oil

The Research Laboratories of the Gulf Oil Corporation, 3800 Gulf Bldg., Pittsburgh, Pa., have developed a new cutting oil known as "Cut-Aid." Thorough tests have shown that this cutting oil aids in increasing production, extending tool life, and producing a better finish on the work. In one case, for example, tool life was extended from three hours between regrinds to eleven hours in cutting aluminum on a Brown & Sharpe automatic screw machine. The finish was also said to have been improved from "fair" to "excellent."

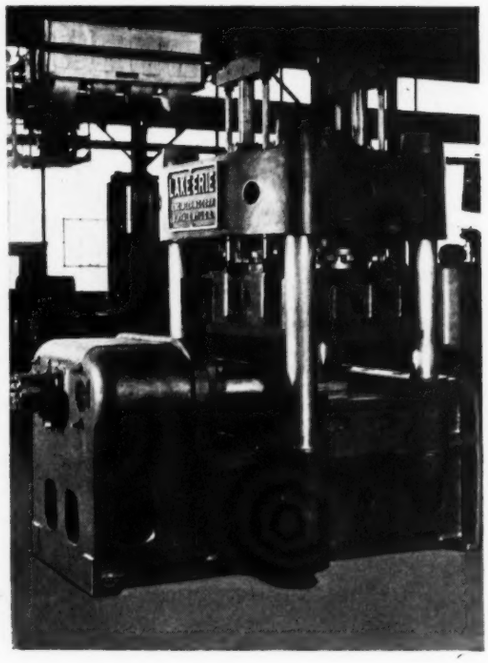
The new cutting oil is especially effective in machining aluminum, which is a very difficult metal to machine and yet one of the most important in the production of aircraft. The oil has also proved highly suitable for cutting magnesium and non-ferrous alloys, and has aided in obtaining better finish and cleaner, sharper, and more accurate threads on threaded work. The new oil has been developed after eight years of study and experimentation on animal oils, such as whale oil, lard oil, and fish oil. These oils were chemically broken down and their best properties synthetically reproduced, after which they were blended with mineral oil. ..... 67

## Lake Erie Hydraulic Plastic-Molding Press

A 450-ton angle type hydraulic press has been developed for molding phenolic plastics by the Lake Erie Engineering Corporation, Buffalo, N. Y. The vertical and horizontal operating units of this new press are shown in the accompanying illustration. The press has a platen 24 by 50 inches, a vertical stroke of 12 inches, and a horizontal stroke of 10 inches. The main bed of the press is of heavy, rugged design, and is cast in one piece to give the strength necessary to maintain correct vertical and horizontal alignment. ..... 68




Vertical Turret Mill Made by Rogers Machine Works, Inc.



Lake Erie Angle Type Phenolic-plastics Molding Press



To obtain additional information on equipment described on this page, see lower part of page 194.


# TODAY DEMANDS PRODUCTION *AND* ACCURACY

## – Use № 12 Plains for your *quality* milling

B·S

The No. 12 Plain Milling Machines shown above are part of a battery on war production. Simplicity and reliability of operation materially reduces the breaking-in period for new operators wherever No. 12s are used.

- ✓ Automatic Milling Cycles
- ✓ Climb or Conventional Milling
- ✓ Ease of Set-up and Operation
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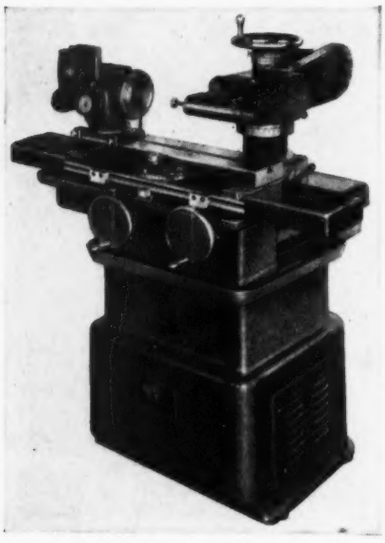
**—and many other advantages to mill efficiently on a wide variety of materials**

# BROWN & SHARPE

## Vernon Universal Tool and Cutter Grinder

The Machinery Mfg. Co., 1915 E. 51st St., Vernon, Los Angeles, Calif., has just brought out a new Vernon universal tool and cutter grinder that has several novel construction features designed to provide smooth and sensitive action. This grinder is adapted for handling all types of tool and cutter grinding, as well as cylindrical and internal grinding, within its capacity.



Vernon Universal Tool and Cutter Grinder Equipped for Internal Grinding

Work 10 1/2 inches in diameter can be swung over the table when mounted on centers. The table has a longitudinal travel of 17 1/4 inches. The maximum work length accommodated between the right- and left-hand tailstocks is 16 inches, and between the headstock and tailstock 13 1/2 inches. The maximum distance between the center line of the work and the grinding-wheel spindle is 10 inches. The column has a transverse travel of 7 1/2 inches, and there is a vertical movement of the wheel-spindle of 6 inches.

The spindle head is driven by a 1/2-H.P., 60-cycle, three-phase, ball-bearing motor having a speed of 3450 R.P.M. The spindle for cylindrical grinding is mounted in anti-friction bearings. An internal auxiliary drive with a spindle of similar construction, but designed for the higher speeds required by smaller wheel sizes, is furnished for internal grinding. Three speeds are provided for external grinding, and two speeds for internal grinding. The spindle head swivels 360 degrees on the column in a horizontal plane and is provided with two locks.

Longitudinal movement is transmitted to the table through a V-belt under the table. The belt is adjustable for stretch and tension. The table movement is obtained through the handwheel on the front right-hand side of the machine and a smaller handwheel at the rear of the grinder. The front handwheel, when placed in the inner position, produces a rapid traverse movement, and when in the outer position, provides for the regular feed. The large circumference of the handwheel is graduated in one hundred divisions, each of which represents a transverse movement of 0.001 inch.

The table can be swiveled 45 degrees in either direction upon the sub-table, and can be locked securely in place. The table is 5 1/2 inches by 28 inches and has a single 9/16-inch T-slot. A wide range of accessories is available for use with this grinder. Two types of wheel-dressers can be had. ..... 69


High-speed Polishing and Finishing Lathe Made by Power Tools, Inc.

## High-Speed Finishing Lathes

Finishing lathes built for high-speed final polishing operations on gears, screws, shafts, ball races, dies, rods, etc., are being placed on the market by Power Tools, Inc., Chicago, Ill. These Model 80 finishing lathes are designed to eliminate the necessity for using bench or engine lathes for polishing operations which require higher speeds than are ordinarily provided on such machines.

This new lathe has a ground hollow alloy-steel spindle with a 1 7/16-inch hole in it, mounted in single- and double-row ball bearings that run in oil within dust-tight housings. A single lever provides stepless regulation of the speed within the available speed range. A quick-stop device on the spindle eliminates lost time by hazardous "hand" stopping.

The lathe is regularly equipped with a draw-bar, 3/4- or 1-inch collet, lever for opening the collet while the spindle is running, 3/4- or 1-H.P. motor, lever-operated starting switch, and spindle nose nut for protecting the thread. The maximum spindle speed available is 5000 R.P.M. The lathe is 14 3/8 inches wide, 29 inches long, and weighs 250 pounds. ..... 70

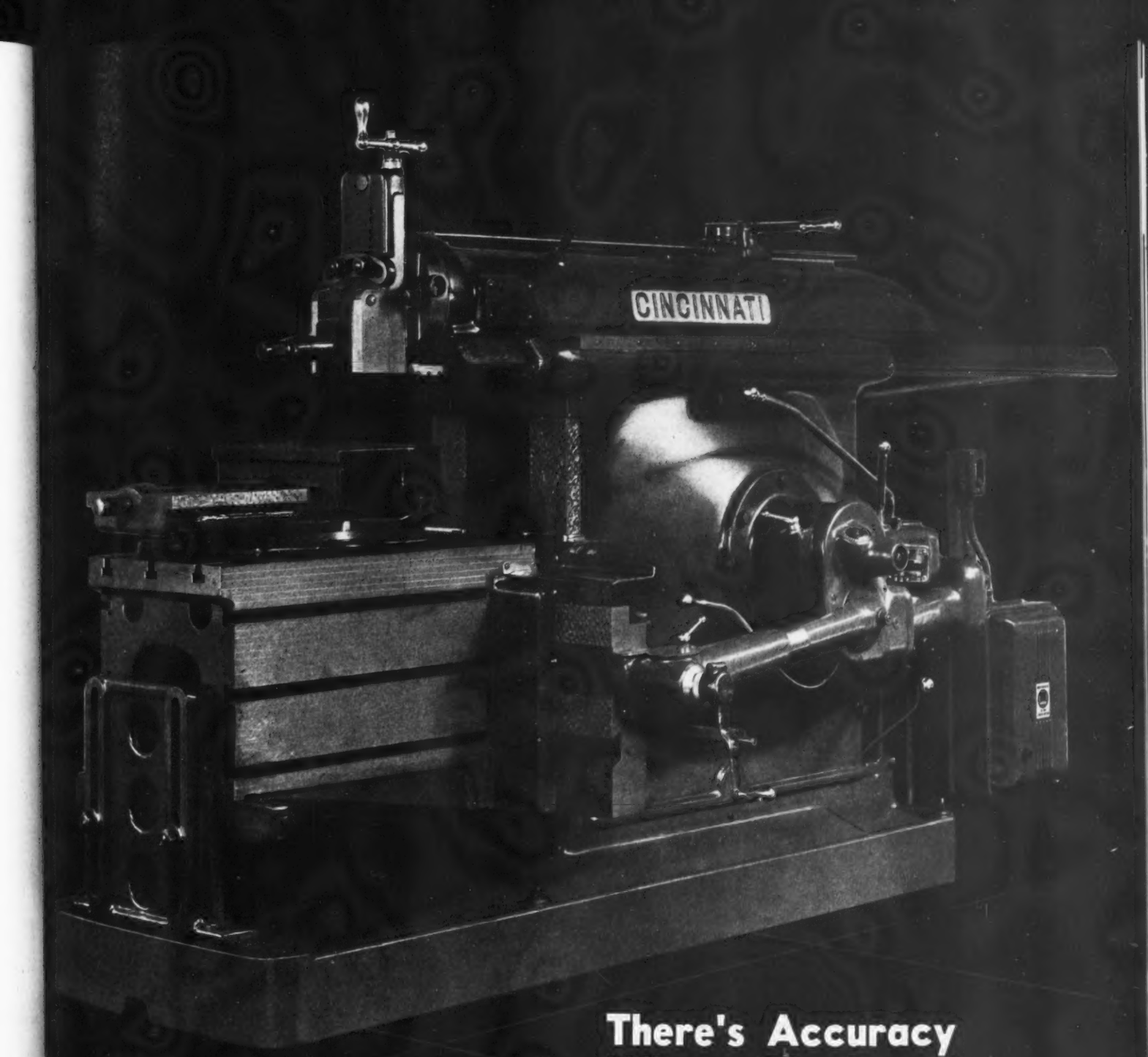
## Jessop "RT" Water-Hardening Tool Steel

For many applications where extreme toughness is desired in preference to all other characteristics, as, for example, in cutter wheels for heavy-duty pipe cutters and similar uses, the Jessop Steel Co., Washington, Pa., is now furnishing a water-hardening tool steel under the brand name "Jessop RT." This steel has unusual toughness and strength, and is especially intended for applications classified as "battering tools."

This steel has enough ductility, even with its unusual hardness and strength, to stretch more than 4 per cent before breaking. Properly heat-treated RT steel has a breaking strength of 323,000 pounds per square inch, and an



To obtain additional information on equipment described on this page, see lower part of page 194.




# There's Accuracy Where Cincinnati Shapers Work

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16" to 36" Stroke
Plain or Universal Table

*Write for Catalog N-1*

# THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES
CINCINNATI, OHIO.

elongation in 2 inches of 4.5 per cent. It acquires a hard case and a tough core in the large and medium sizes. Pieces 1 1/2 inches in diameter, for example, will have a fine-grained case approximately 3/16 to 1/4 inch deep, with a hardness of about C 61 to C 63 Rockwell. Smaller sizes, under 3/4 inch in diameter, will harden throughout. ..... 71

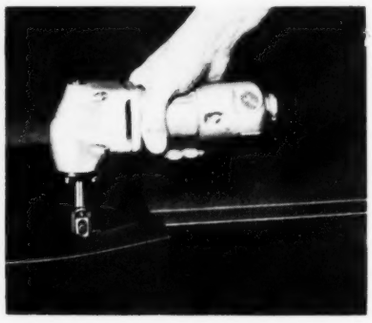


Fig. 1. Black & Decker No. 18 Lectro-shear

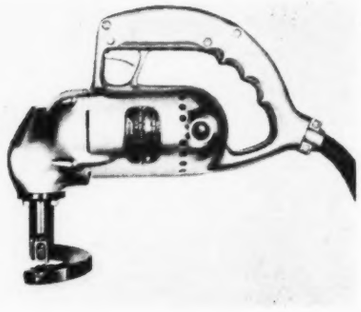


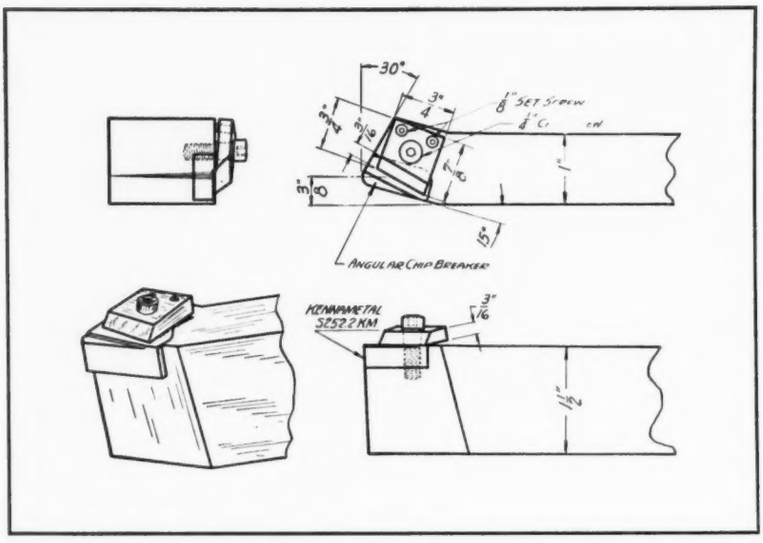
Fig. 2. Improved No. 16 Lectro-shear

## Clamped-on Carbide Tool Tips

The McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., has developed a simple clamp designed for holding carbide tips on steel shanks without brazing. This clamping arrangement can be used by shops that make up their own carbide cutting tools, to simplify the work and at the same time assure that the tools will be free from strain. The tool shank is milled out as shown in the accompanying illustration, care being taken to obtain as flat a surface under the tip as possible. The S A E 1045 steel clamp is not employed to break the chips, as if used for this purpose, it would soon be eroded to such an extent as to make it unfit for use.

Brazing strains are, of course, entirely eliminated by this arrangement, and the grinding is greatly simplified, since only the Kennametal is in contact with the grinding wheel. As no steel is in contact with the wheel, loading up and glazing of the special silicon-carbide grit is prevented. One S A E 1045 shank can be used for about four tips before it becomes so cut and battered that it must be replaced. Shanks made of harder steel would, of course, have a longer life.

As the tip is reground, it is moved forward and outward under the clamp, shims being placed behind it. When the tip becomes too small for service in its holder, it can frequently be brazed to a smaller shank for use in lighter turning or boring operations. The freedom from strain due to unequal expansion of tip and shank is claimed to make a great difference in the tool life, particularly in the case of tools made in plants under widely varying conditions. In one plant, clamped-on Kennametal tips were used for months without a single case of tip breakage. ..... 72




Clamped-on Carbide-tipped Tool Developed by McKenna Metals Co.

## Improved Black & Decker Lectro-Shears

The two sizes of Lectro-shears made by the Black & Decker Mfg. Co., 735 Pennsylvania Ave., Towson, Md., which are shown in Figs. 1 and 2 have been redesigned to improve their handling and operating characteristics. The No. 18 Lectro-shear (Fig. 1), for cutting sheet steel in thicknesses up to 18 gage, has been reduced in size, or outer dimensions, so that the motor housing forms a comfortable operating handle. The operating balance and control of this tool have been improved by the reduction in length and weight. The power and capacity remain the same as in previous models.

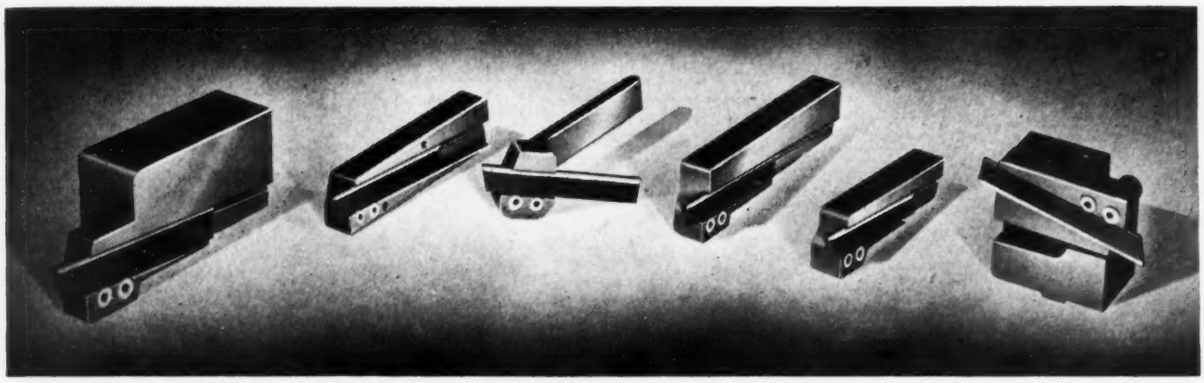
The larger No. 16 Lectro-shear (Fig. 2) is now being equipped with an improved operating handle which gives the tool better balance and easier control when cutting to curved and irregular lines. It is equipped with an instant-release trigger switch and with a locking pin for continuous operation. The handle is so shaped that it can be used over the tool or at the rear end. The power and capacity of this tool are the same as in previous models. ..... 73

## Wilson All-Position Welding Electrode

A new electrode designed specifically for all-position welding of mild steel with alternating-current welding machines has been developed by the Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City. This electrode, known as the Wilson No. 530, is designed to meet the requirements of the American Welding Society Classification E6011 the American Bu-



**To obtain additional information on equipment described on this page, see lower part of page 194.**



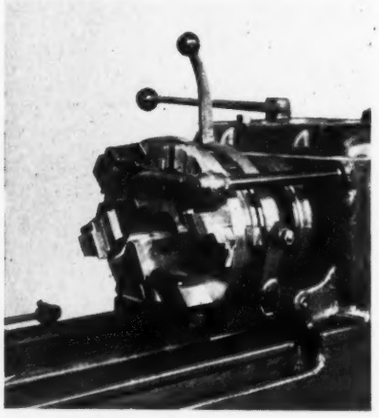
**Tool-holders for Holding Luers Cutting-off Blades on Different Types of Screw Machines**

reau of Shipping, and Group H1G and B1G for alternating current. Physical tests of all-weld-metal tensile specimens indicate an ultimate tensile strength of 70,000 to 75,000 pounds per square inch and an elongation in 2 inches of 25 to 30 per cent with the material in the "as welded" state. With the stress relieved, the tests indicate an ultimate tensile strength of 65,000 to 75,000 pounds per square inch with an elongation of 30 to 35 per cent. This electrode is made in 1/16-, 3/32-, 1/8-, and 5/32-inch sizes. ..... 74

## Lanco Die-Head for Large-Diameter Fine-Pitch Threads

A special Lanco die-head has been introduced to the trade by the Landis Machine Co., Waynesboro, Pa. The new die-head has an exceptionally wide capacity range, which is obtained by using an oversize closing ring on the face of the die-head to support extended chaser-holders. This die-head is especially suitable for threading large-diameter, fine-pitch threads where the thread length is relatively short.

The die-head, as shown in the illustration, is equipped with chaser-holders and chasers for cutting 9 3/4-inch, 8-pitch threads. By employing chaser-holders having a still larger offset seating surface for the chasers, work 12 inches in diameter can be threaded. The maximum thread length that can be produced with chaser-holders of the type illustrated is approximately 2 inches. ..... 75



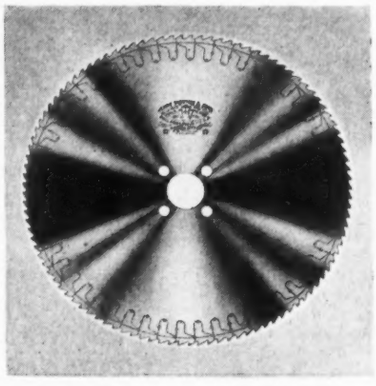
**Special Lanco Die-head Developed by the Landis Machine Co.**

## Empire Tool-Holders for Screw-Machine Cutting-off Blades

The Empire Tool Co., 8786 Grinnell Ave., Detroit, Mich., has introduced on the market six new tool-holders designed to accommodate Luers patented cutting-off blades on six types of screw machines for which holders of this type have not previously been available. These holders enable the Luers blades to be used on the Greenlee four- and six-spindle automatics, New Britain automatics, all lathe and hand screw machines with round posts, Acme-Gridley R and RA Series, and Gridley Models F and G multiple-spindle automatics.

The Luers holders are designed to permit the cutting-off tool to be set up in the machine quickly and easily, and to allow the operator to remove the blade for resharpening and replace it precisely in the original position without disturbing the set-up.

The blade is held rigidly in place by means of two cams which force the top surface of the blade against the ground surface of the holder, and thus provide a solid bearing. Although capable of exerting a heavy grip on the blade, the locking device can be quickly and easily released. ..... 76



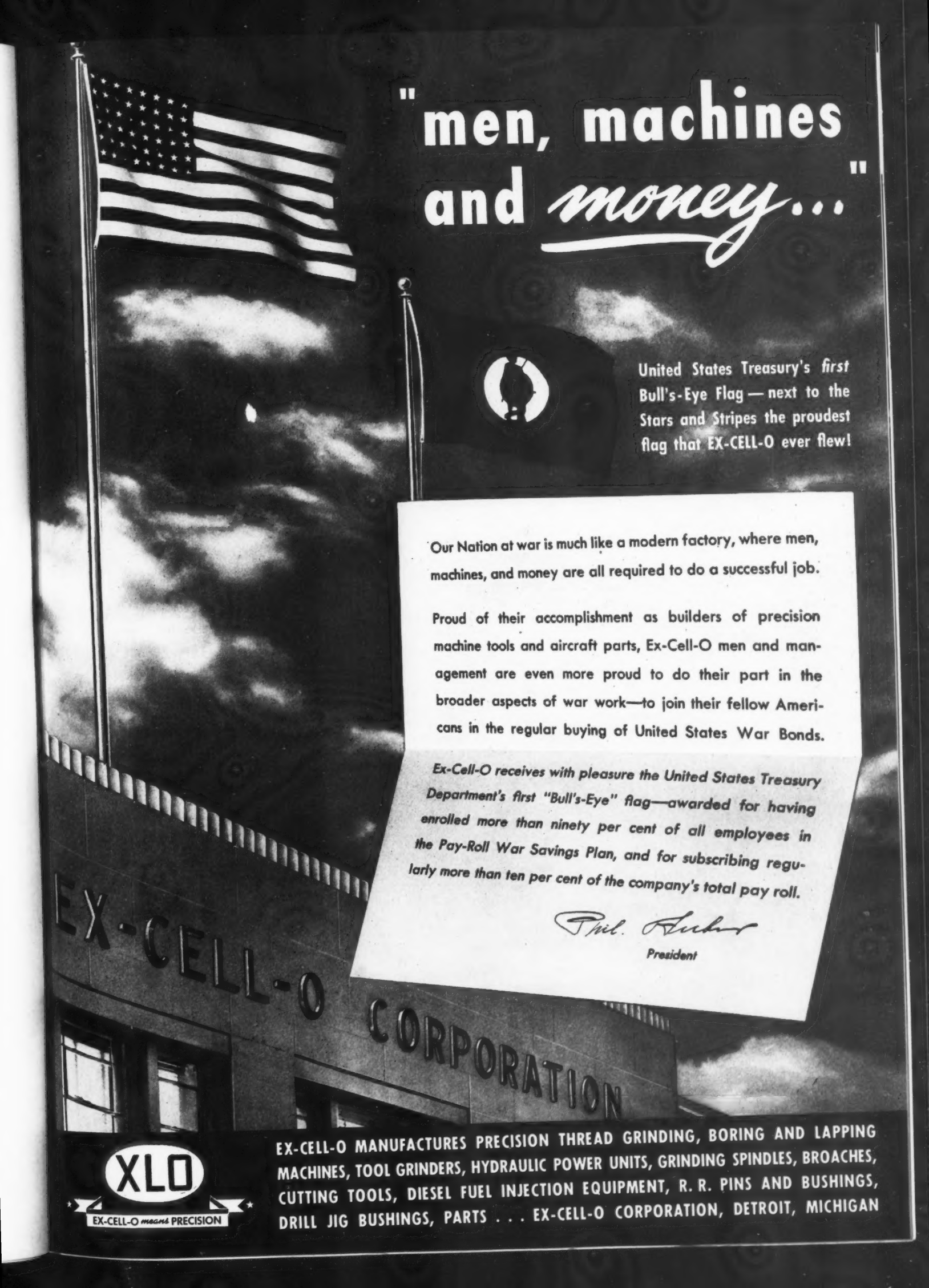
**Disston Circular Metal-cutting Saw with Inserted Tooth Sections**

## Disston "Inserted-Section" Metal-Cutting Saw

Henry Disston & Sons, Inc., Philadelphia, Pa., have just placed on the market a new "inserted-section" saw. This circular metal-cutting saw has been developed to combine the advantages of the inserted-tooth type and the solid-tooth type. It is a continuous-rim saw having inserted sections rather than inserted teeth, and can be readily sharpened on an automatic grinder. The new saw provides a maximum number of teeth for any given diameter, and can be operated at speeds up to 5000 feet per minute. This design permits a thinner blade and cutting edge than is customary with saws having individual inserted teeth.



To obtain additional information on equipment described on this page, see lower part of page 194.


"men, machines and money..."
United States Treasury's first Bull's-Eye Flag — next to the Stars and Stripes the proudest flag that EX-CELL-O ever flew!
Our Nation at war is much like a modern factory, where men, machines, and money are all required to do a successful job.
Proud of their accomplishment as builders of precision machine tools and aircraft parts, Ex-Cell-O men and management are even more proud to do their part in the broader aspects of war work—to join their fellow Americans in the regular buying of United States War Bonds.
Ex-Cell-O receives with pleasure the United States Treasury Department's first "Bull's-Eye" flag—awarded for having enrolled more than ninety per cent of all employees in the Pay-Roll War Savings Plan, and for subscribing regularly more than ten per cent of the company's total pay roll.
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EX-CELL-O CORPORATION
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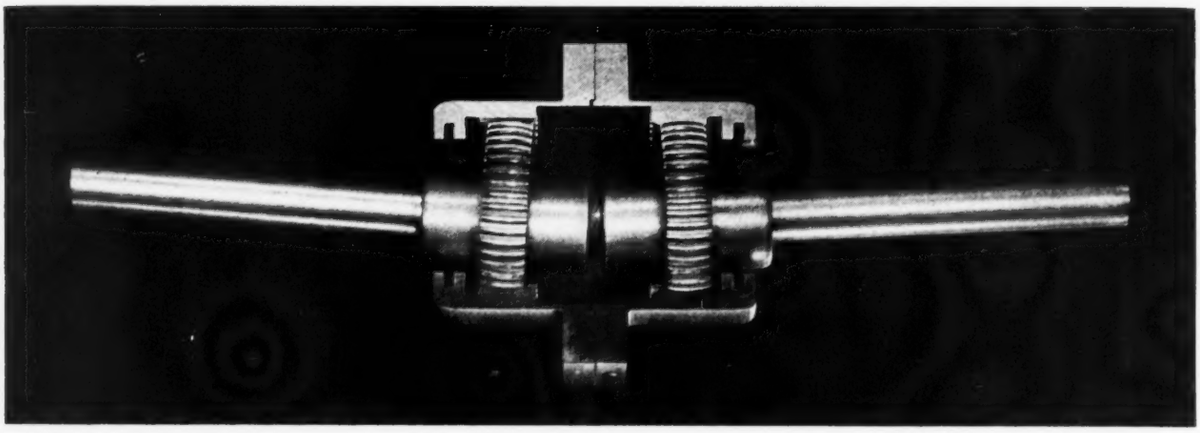
EX-CELL-O means PRECISION
EX-CELL-O MANUFACTURES PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DIESEL FUEL INJECTION EQUIPMENT, R. R. PINS AND BUSHINGS, DRILL JIG BUSHINGS, PARTS . . . EX-CELL-O CORPORATION, DETROIT, MICHIGAN

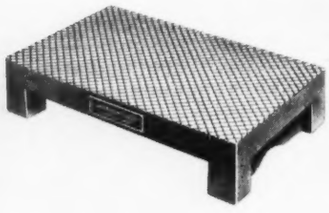


Barcus Gear Type Coupling for Driving and Driven Shafts

The inserts can be quickly and easily replaced should they be accidentally damaged. It is not necessary to return this saw to the factory for the refitting of teeth, as such work can be done in the user's plant or in a nearby saw repair shop. ..... 77

## Precision Lapping Plate

The American Gauge Co., 125 Bayard St., Dayton, Ohio, has brought out an improved lapping plate for tool-room use, which is 8 inches wide by 12 1/2 inches long by 2 1/2 inches high. The fine-grain cast-iron block, or surface plate, is about 1 1/8 inches thick, and is mounted on four legs, as shown in the illustration. The lapping surface is cut with 1/16-inch grooves in a diamond pattern, the grooves being spaced 1/4 inch apart and at right angles to each other. These grooves are positioned at an angle of 45 degrees with the sides of the plate. It is claimed that this arrangement gives the lap a superior cutting action. The lapping plate is first ground and then lapped to a flat, accurate surface. ..... 78



Precision Lapping Plate Made by American Gauge Co.

## Barcus Gear Coupling

A coupling for driving and driven shafts comprising a cylindrical housing shell with internal cut gears having stub teeth and a 20-degree pressure angle, which insure positive driving, and at the same time, provide for angular misalignment, has been brought out by the Barcus Engineering Co., 3931-35 Falls Road, Baltimore, Md. The driving and driven shafts are connected to the hubs of generated gears, as shown in the accompanying illustration. Each gear is cut on a true central segment of a sphere, the teeth being of constant width.

The teeth of each spherical gear mesh with the stub teeth of the housing, permitting a smooth ball joint action which serves to reduce friction and pressure on the shaft bearings when the shafts are out of alignment. The specially designed spherical gear is in full mesh with the internal gear on the pitch line at all times.

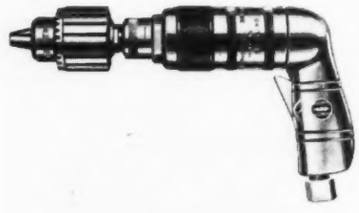
The spherical gear permits misalignment of either shaft up to 3 degrees, giving a total misalignment of 6 degrees for the driving and driven shafts. This allowance for misalignment enables the coupling to operate efficiently in many difficult mechanical arrangements, and permits the use of various mechanical designs not formerly practicable. One-half of the coupling can be employed to connect a shaft to a flywheel or other rotating member. A gasket between the flanges of the coupling insures an oil-tight seal. The bolt holes are counterbored, so that the bolt heads and nuts do not extend beyond the flange surface, as a safety measure. The oil-hole is closed by a safety set-screw.

This coupling is now available in four sizes, for maximum bores of 1 1/4, 1 3/4, 2 1/4, and 3 inches. The horsepower capacity per 100 R.P.M. ranges from 18 for the smallest size up to 128 for the largest size. The maximum speed for the smallest size is 15,000 R.P.M., and for the largest size 6200 R.P.M. The smallest coupling weighs 16 pounds, and the largest 78 pounds. ..... 79

## Aro Pneumatic Drill

The addition of 3/8-inch capacity air drills in straight and right-angle types to the line of rotary pneumatic tools made by the Aro Equipment Corporation, Bryan, Ohio, is announced. These drills are suitable for a wide range of work in shipyards, aircraft plants, and other industrial plants.

An extensive line of small pneumatic tools for drilling, screwdriving, nut-setting, grinding, filing, polishing, sanding, and similar operations is also being manufactured by this company. ..... 80



Pneumatic Drill Made by the Aro Equipment Corporation



To obtain additional information on equipment described on this page, see lower part of page 194.

# 5 Ways to Get Faster Deliveries of *Special* Carboloy Tools and Blanks

A "special" Carboloy tool or blank is one made to special shape, size, tolerance or grade. Any one or all of these requirements—means a "special". It requires special handling apart from our regular production line of standards. To help you get essential specials with a minimum of delay and expense, we list below 5 suggestions to follow when ordering.

BUT—before you order—check your needs against Carboloy Standard Tools & Blanks. Produced and placed in stock by the thousands daily, Carboloy Standards are suitable "as is"—or adaptable by grinding—to 80% of all turning, boring, facing jobs. In this crucial period when every minute counts, you can usually save 6 to 8 weeks delivery by ordering standards instead of specials whenever possible.

**FIVE POINTS TO CHECK WHEN ORDERING "SPECIALS"**

**1. Follow these suggestions when specifying tolerances—**

(a) Be *sure* your tolerances are as liberal as job will permit.

(b) Specify tolerances on all decimal dimensions.

(c) Use our standard tolerances whenever possible. These are:

**STANDARD TOLERANCES**

| TOOLS | | | BLANKS | |
|---|---|---|---|---|
| Shank Width and Height | Finished Tools | Milled and Brazed Tools | Blank Dimensions | Tolerance |
| 1″ and less | +.000; −.010 | +.000; −.015 | Up to 3/8″ | +.015; −.000 |
| Over 1″ | +.000; −.015 | +.000; −.015 | 3/8″ to 1″ | +.020; −.000 |
| | | | 1″ to 2″ | +.040; −.000 |
| Shank Length: | | | 2″ to 3″ | +.060; −.000 |
| 4 1/2″ and less | + 1/16; − 1/16 | | 3″ to 4″ | +.080; −.000 |
| 4 5/8″ to 7 1/2″ | + 1/8; − 1/8 | | 4″ to 6″ | +.100; −.000 |
| Over 7 1/2″ | + 1/4; − 1/4 | | Over 6″ | +.125; −.000 |

**2. Specify the following stock sizes of shank steels:**

| | | | | |
|---|---|---|---|---|
| 1/4″ square | 5/8″ square | 7/8″ square | 5/8″ x 1 1/4″ | 1″ x 1 1/2″ |
| 5/16″ square | 1/2″ x 3/4″ | 5/8″ x 1″ | 3/4″ x 1 1/2″ | 1 1/4″ x 1 1/2″ |
| 3/8″ square | 3/4″ square | 3/4″ x 1″ | 1″ x 1 1/4″ | 1 1/2″ square |
| 1/2″ square | 1/2″ x 1″ | 1″ square | 1 1/4″ square | 1 1/2″ x 2″ |

**3. Design tools to use standard blanks. They are carried in stock.**

**4. Use the same standard relief and rake angles that we use on our standard tools. Our manufacturing facilities are set up to produce these angles rapidly. (Send for catalog GT-142.)**

**5. Furnish at least two (preferably three) sets of blueprints on all special orders. This eliminates delays for duplications of prints.**

**CARBOLOY COMPANY, INC.**

11147 E. 8 MILE BLVD., DETROIT, MICH.

Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh

*Canadian Distributor:* Canadian General Electric Co., Ltd., Toronto, Canada

The Mark of CARBOLOY

***Order "Specials" When They Are Essential . . .***

**BUT . . . whenever possible use Carboloy STANDARD tools and blanks . . HERE'S WHY:**

Carboloy Standards are in "mass" production. Shipped from stock. No delays for drafting, quotations or special ordering. You save 6 to 8 weeks delivery time.

You can quickly and easily torch braze standard blanks to your steel shanks in your shop. . . . Tool up rush jobs *FAST!*

You can quickly grind standard tools to special shapes. Carboloy standards are adaptable to 80% of all turning, boring, facing jobs.

**CARBOLOY** CEMENTED CARBIDES

TOOLS • DIES • DRESSERS
CORE BITS • MASONRY DRILLS
• WEAR RESISTANT PARTS •

FOR THE MANUFACTURING • MINING • TRANSPORTATION • CONSTRUCTION INDUSTRIES

## "Arcometer" for Laying-out or Spacing Operations on Circular Work

An instrument for such operations as spacing or laying out bolt holes on circular work has been patented by H. F. Peterson, of Rockford, Ill. The design of this instrument, which is known as the "Arcometer," is based on the theorem that the perpendicular bisectors of any two chords on a circle determine the center of the circle. The instrument, which is illustrated in Fig. 1, has been employed in several shops, where it has been found very useful. Typical applications include the laying out of accurately spaced holes to be drilled on circular flanges, and the checking of drilled work of this kind. The spacing of holes or ribs on patterns for motor frames, spacing vanes on impellers, and similar work can also be accomplished with this instrument.

In applying the "Arcometer," the two heads are held against the outer or inner edge of the circular work so that the two corners of each head are in contact with the circular surface, as indicated in Figs. 2 and 3. The center screw is then tightened slightly and the arms are turned to the required angle for the spacing desired, after which the center screw is locked. The "Arcometer" is then ready for laying out radial spacing lines on the lay-out circle or at a predetermined distance from the center of the work. It will be noted that, by the use of this instrument, many of the measurements ordinarily necessary are eliminated.

## War Work Set to Music Increases Production

To relieve nervous fatigue, music has been introduced as a stimulating factor at the Westinghouse Lamp Division, Bloomfield, N. J. Loud-speakers, stationed in the main manufacturing areas, broadcast music for five and one-half hours a day. Band music greets the workers as they assemble for the first shift at 7 o'clock in the morning and continues for fifteen minutes. Half-hour periods of music are then scheduled during the remainder of the eight-hour shift, and, of course, are repeated for the second shift. The program was arranged by the plant's Joint Committee of Labor and Management. Frequency modulation and standard broadcast programs will also be transmitted by the system.

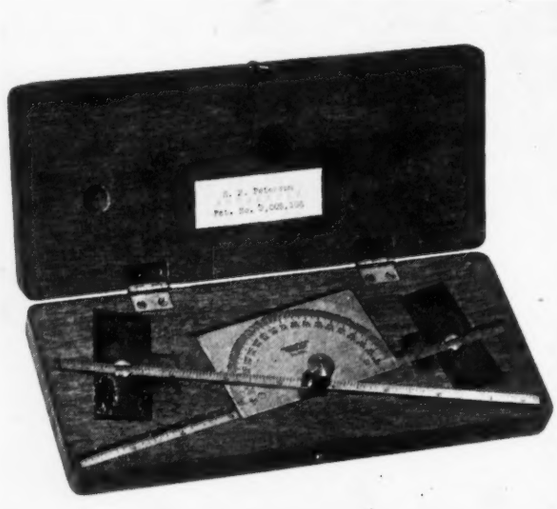


Fig. 1. (Right) The "Arcometer," a New Instrument Designed for Use in Laying out Accurately Spaced Holes along the Circumference of a Circle

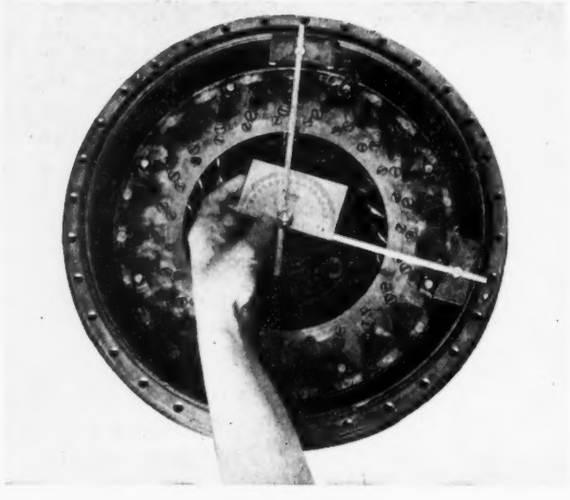


Fig. 2. (Below Left) Method of Checking Accuracy of Hole Spacing with "Arcometer." Fig. 3. (Below Right) Laying out Accurately Spaced Holes

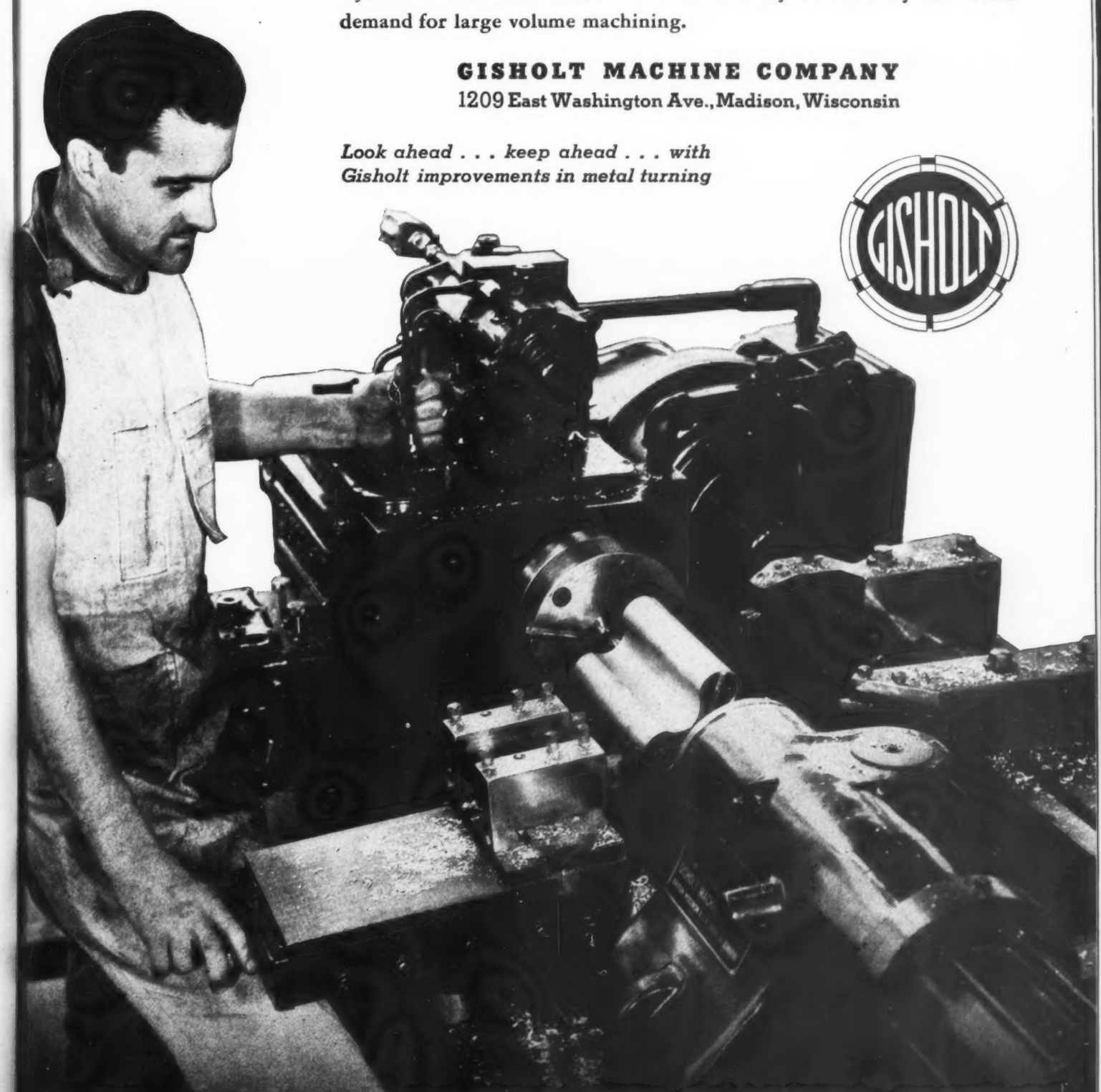
# What man could stand the hours? ..or match the speed?

AROUND the clock, seven days a week, the *Gisholt Hydraulic Automatic Lathes* keep at it—repeating their automatic cycles of operation with the swift precision that no skilled man could ever match.

The time-saving, man-saving, money-saving possibilities with *Gisholt Hydraulic Automatic Lathes* are more clearly revealed by the war's demand for large volume machining.

**GISHOLT MACHINE COMPANY**
1209 East Washington Ave., Madison, Wisconsin

***Look ahead . . . keep ahead . . . with Gisholt improvements in metal turning***




TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

## New Chromium Plating Method for Tools

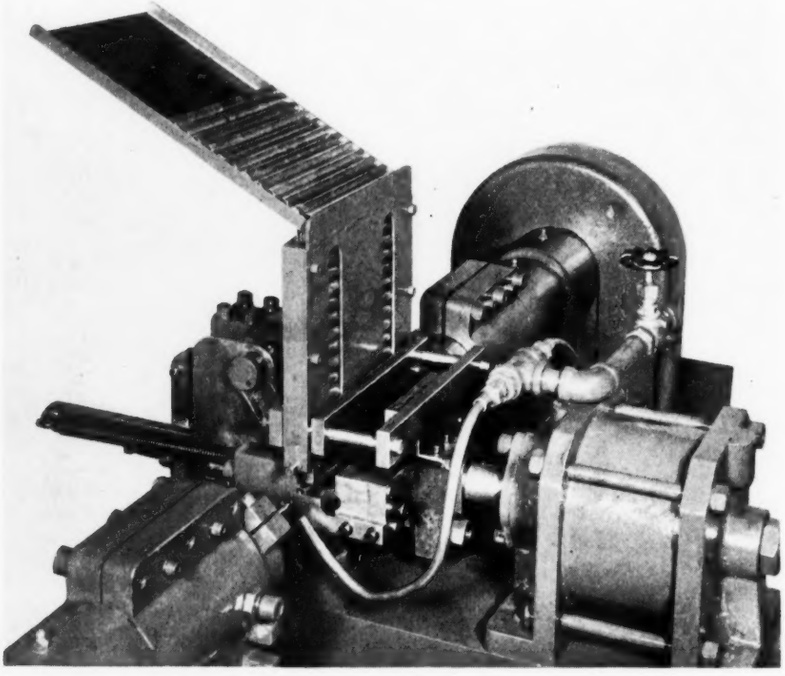
In the course of its efforts to develop means for prolonging the life of printing plates, the Crowell-Collier Publishing Co. has developed a method of chromium plating that is now being applied to the treating of cutting tools. This process of plating and treating cutting tools is simply a flash plating method, the plating having a depth of only about 0.0001 inch. The important point is that this thin plating becomes an integral part of the base metal; no chipping or peeling of the chromium plating has been experienced.

The company has applied for a patent on this process, and is offering other manufacturers, temporarily, the opportunity to make use of the method without royalty or other payments, it being understood that the tools treated will be used only on contracts pertaining to the war effort, and that the use of the process without payment covers only the period during which present Government contracts are being completed, or the duration of the war, which ever terminates first.

A variety of cutting tools from a number of manufacturers have been treated, including ordinary high-speed steel tool bits, milling cutters, drills, and reamers. These tools have proved successful when used on stainless steels, various S A E steels, cast iron, armor plate, copper, and aluminum. It is suggested that manufacturers who are interested communicate with Axel Lundbye, Crowell-Collier Publishing Co., Springfield, Ohio.

## Machining Both Ends of Rods or Tubes on a Two-Spindle Machine

Boring, tapping, chamfering, facing, threading, centering, reaming, and profiling operations are performed efficiently on both ends of brass and copper rods by a two-spindle profiler equipped as shown. This machine is made by the Pines Engineering Co., Aurora, Ill. The addition of an automatic chute feed is claimed to have increased the production of the machine as much as 30 per cent.



Machine Equipped with Automatic Chute Feed for Operations on Both Ends of Rods and Tubes

## Care of Farm Machines

More than 125,000 young men in practically every state are now receiving instruction in the care of farm machinery. The work is carried on by the U. S. Office of Education under a $15,000,000 Congressional grant; but in many instances, private business firms and manufacturers are cooperating.

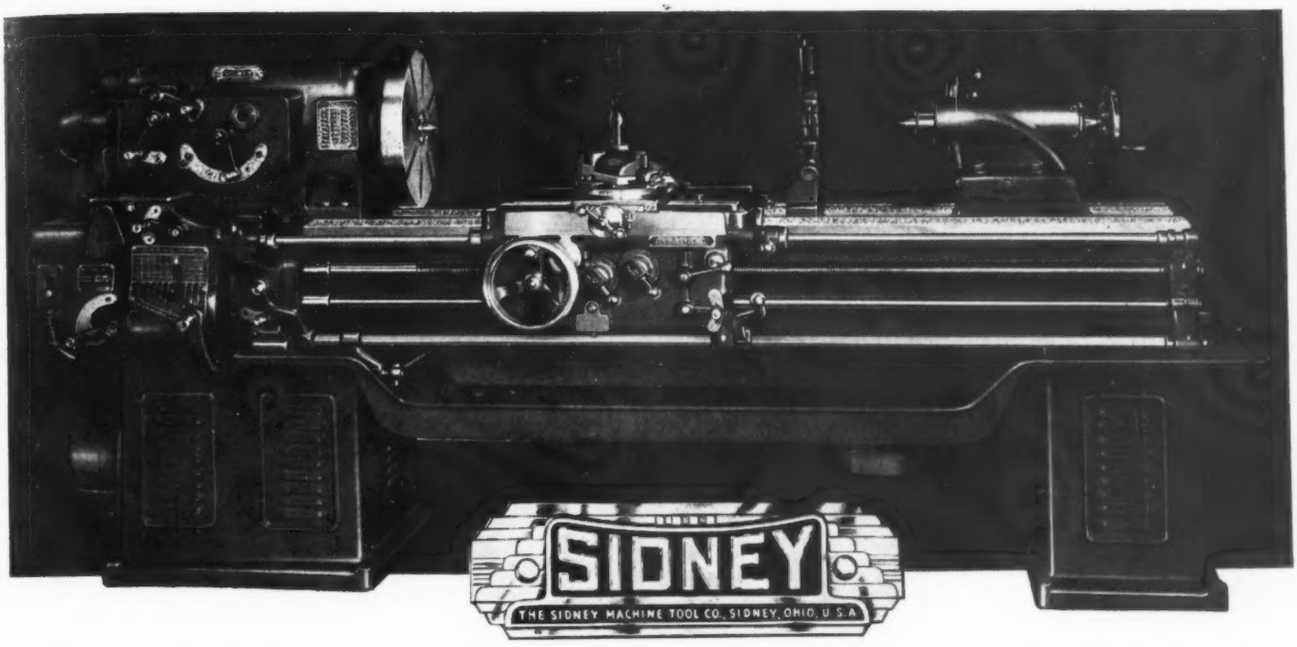
Typical of this cooperation is the instruction offered at Frankfort, Ky., where thirty young men of the surrounding community are meeting four nights a week in a local machine shop, with the firm's own trained men serving as instructors. Arc and acetylene welding, forging, motor repairs, woodworking, and elementary principles of electricity are being taught under this program. In addition to meeting the present emergency by preventing unnecessary depreciation of farm machinery during the war, a long-range aim of the program is to prepare the farmers of tomorrow for greater mechanization in agriculture.

* * *

## Scrap Collection Saves 100,000 Tons of Materials in a Year

By scrap collection drives and intensified salvaging activities, the Westinghouse Electric & Mfg. Co. saved 100,000 tons of important materials needed for war manufacture in the past year. Ray Schmidt, supervisor of the Westinghouse reclamation and salvage department, says that the first function of a salvage department is to *prevent* scrap, and the second, to save scrap when it is a necessary result of the manufacturing operations.

In addition to its regular salvage department activities, the Westinghouse company has inaugurated periodical intensified clean-up drives for more salvageable material and scrap. Recently, in one department of the East Pittsburgh Works, one of these four-day drives uncovered more than 300,000 pounds of scrap metals that could be turned over to the metals industries for reworking. Similar drives in other departments are being planned. The vital necessity of collecting all available scrap is now thoroughly appreciated throughout industry.

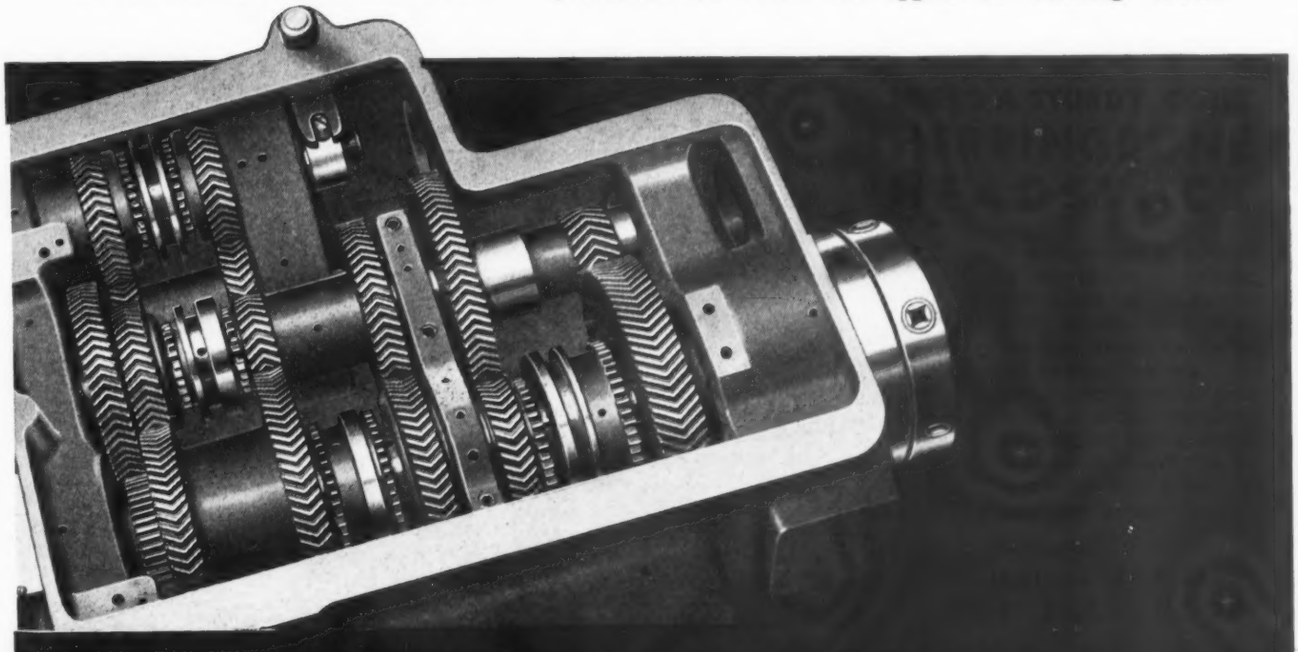



# FAST—ACCURATE—QUIET

# SIDNEY LATHES

**8—12—16 SPEED MODELS**
**14" to 36" CAPACITY RANGE**

The many advantages of the continuous tooth Herringbone gearing are not only well known but generally recognized for the greater strength and smoother action resulting from increased tooth contact. Sixteen speeds and forty-eight changes of threads assure the maximum possibilities from all types of cutting tools.



*The* **SIDNEY MACHINE TOOL** *Company*

**SIDNEY U.S.A. OHIO**

# NEWS OF THE INDUSTRY

## California

JAMES F. MCNAMARA, mill products sales manager of the International Nickel Co., has been made chairman of the board of directors of the Harvill Aircraft Die Casting Corporation, Los Angeles, Calif. He has been with the International Nickel Co. for thirty-one years. He is also a director of the Lukens Steel Co., Coatesville, Pa. F. M. HOEFLER has been elected vice-president and general manager of the Harvill Aircraft Die Casting Corporation. For the last three years, Mr. Hoefler has taken an active part in the growth of the firm and has been responsible for many of the developments in die-casting and pressure-mold casting pioneered by the firm. Previous to becoming connected with the Harvill organization, he was with Douglas Aircraft and Vultee Aircraft.

R. E. POWERS has been appointed Pacific Coast district manager of the manufacturing and repair department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He will be located in Emeryville, Calif.

## Delaware and Maryland

LOBDELL CAR WHEEL CO., Wilmington, Del., announces that the firm name has been changed to the LOBDELL CO. There is no change in the ownership or management of the company. The words "Car Wheel" were eliminated from the name to obviate confusion, since the nature of the company's business was changed with the acquisition of the Nazel Engineering & Machine Works' line of forging hammers and slotting machines.

WESTINGHOUSE ELECTRIC & MFG. CO. announces that the entire manufacturing plant of the X-Ray division of the company has moved from Long Island City, N. Y., to Baltimore, Md.

## Illinois and Michigan

KROPP FORGE AVIATION CO. has been formed as an associate company of the Kropp Forge Co., Chicago, Ill. A new plant is in the course of construction on property adjacent to the parent company, consisting of a drop-forging manufacturing plant almost equal in size to the present plant. Drop-hammers ranging from 6000 to 20,000 pounds capacity will be installed, together with all required auxiliary equipment. A feature of the new plant will be the mechanical handling of raw materials, finished parts, and scrap.

SCULLY MACHINERY & EQUIPMENT CORPORATION has been formed to take over the used and rebuilt foundry equipment business of SCULLY-JONES & CO., Chicago, Ill. The firm will occupy improved facilities at 2031 W. 74th St., Chicago, where 50,000 square feet of floor space is available. J. A. SCULLY, president of Scully-Jones & Co., will act in the same capacity for the new organization, and R. P. SCULLY will act as vice-president and sales manager.

NED H. DEARBORN has been made executive vice-president and managing director of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill. He succeeds W. H. CAMERON, who is retiring after almost thirty years as managing director of the Council. Since 1934, Mr. Dearborn has been dean of the Division of General Education of New York University, which position he now leaves.

SCIAKY BROS., builders of precision electric resistance welding machines, have moved into a new building at 4915 W. 67th St., Chicago, Ill. The demand for the company's welding machines made it necessary to build a new factory with ample space for increased production and for broadening the company's lines.

DOALL CO., 1201 Thacker St., Des Plaines, Ill., has further expanded its contour saw laboratory, housing this department in a building separate from the main plant. The DoAll laboratory, a customer service department, has long been called upon to solve many cutting problems of narrow-blade saw users.

H. W. ANDERSON has been elected vice-president of the Aviation Division of the Whiting Corporation, Harvey, Ill. M. J. RICE has been made vice-president of the Quickwork-Whiting Division of the corporation.

SUPREX GAGE CO., Ferndale, Mich., has just completed a $750,000 expansion program. The company moved into its new plant on July 7, and early in September will have achieved peak production, quadrupling its last year's output.

ANKER-HOLTH MFG. CO., with plants at Port Huron, Mich., and Chicago, Ill., has been awarded the Chicago Ordnance District banner. The presentation took place on July 20 at the company's Irving Park Blvd. plant in Chicago.

## New England

ABRASIVE MACHINE TOOL CO., East Providence, R. I., announces the following new representatives in the areas formerly served by Henry Prentiss & Co., Inc.: RUSSELL, HOLBROOK & HENDERSON, 99 Hudson St., New York City, will cover metropolitan New York, northern New Jersey, and eastern New York State, including Schenectady; C. H. BRIGGS MACHINE TOOL CO., Onondaga Hotel Bldg., Syracuse, N. Y., will cover Syracuse and adjacent territory; GEORGE KELLER MACHINERY CO., 1807 Elmwood Ave., Buffalo, N. Y., will cover the Buffalo-Rochester area; MOTCH & MERRYWEATHER MACHINERY CO., Cleveland, Ohio, has been assigned Erie County, Pa., in addition to the company's regular territory; SWIND MACHINERY CO., Philadelphia, Pa., will add to its usual coverage several counties in northern Pennsylvania; the New England area will be handled from the home office at East Providence, R. I., for the present.

PRATT & WHITNEY Division NILES-BEMENT-POND CO., West Hartford, Conn., recently awarded gold service pins to about ninety employes. The ceremony was held at noon in the plant, and the presentations were made by E. J. O'Malley, machine tool general superintendent of the small tool and gage departments. Clayton R. Burt, president of the company, presided. NICHOLAS W. PRUMBAUM received a fifty-year pin, and two forty-year pins were awarded to JOHN E. MAYS and ALEXANDER G. WHITEHEAD. There were 21 thirty-year pins, 20 twenty-year pins and 44 ten-year pins awarded.

CLARENCE E. STEVENS has been elected vice-president in charge of plant operations of the Norma-Hoffmann Bearings Corporation, Stamford, Conn. Until recently, Mr. Stevens was vice-president in charge of manufacturing of the Electrolux, Inc., plant at Old Greenwich, Conn.

HAMILTON STANDARD PROPELLERS DIVISION of THE UNITED AIRCRAFT CORPORATION, East Hartford, Conn., has received the Army-Navy Joint Production Award for its "contribution of the highest importance to the fighting of this war."

H. K. CLARK, vice-president and general manager of the Norton Co., Worcester, Mass., who recently returned to Worcester after nine months' service as a dollar-a-year man in Washing-

# WAR PRODUCTION- 33½ HOURS PER DAY!

## SUNOCO EMULSIFYING CUTTING OIL

### increased output 40%...stepped up tool life...improved finish

It takes bullets to win battles, and American ingenuity is finding ways to set amazing records in the race for arms production.

For example, in a plant turning out bullet-assembling machines, excess heat on tools and work, poor finish, and operators' skin complaints were restricting production. A Sun Oil Engineer — one of those capable Doctors of Industry — was called in to improve conditions. He recommended a change in cutting fluid . . . to Sunoco Emulsifying Cutting Oil. Now they're using Sunoco . . . and rate of production has increased 40% — equivalent to an extra 9½ hour shift every day! Finish has also improved, and skin trouble vanished.

Sun Doctors of Industry and Sunoco Emulsifying Cutting Oil stand ready . . . willing . . . and able to help you step up production in your shop. For helpful case histories of what they have accomplished for other leaders in the metal working industry, write for your free copy of "Helping Industry Help America."


**SUN OIL COMPANY • Philadelphia**

*Sun Oil Company, Ltd., Toronto*

LET'S GO! U.S.A. KEEP 'EM FLYING!

SUNOCO

# SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

ton, has been "drafted" by the Navy and is now a member of the Army and Navy Munitions Board with the rank of Lieutenant Commander.

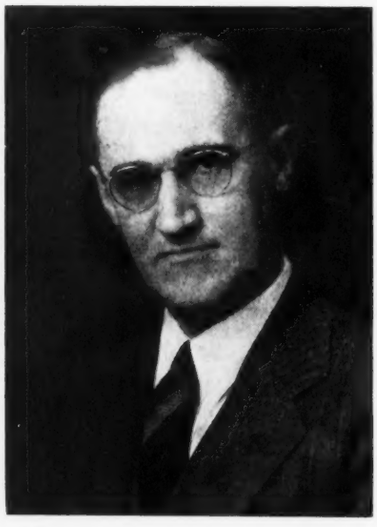
GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., was awarded the joint Army-Navy Production Award on August 19 in recognition of exceptional performance in the war effort.

## New York and New Jersey

STRIPPIT CORPORATION, 1200 Niagara St., Buffalo, N. Y., has purchased a modern building of steel and concrete at 345 Payne Ave., North Tonawanda, N. Y., a few miles north of Buffalo. The production machinery has been moved from the Buffalo plant to the North Tonawanda plant. By the middle of September, all production and the general and executive offices will be at North Tonawanda. The new facilities were necessary in order to meet the demand for Wales self-contained punching and notching units and other products of the company.

GEORGE KELLER MACHINERY CO., 1807 Elmwood Ave., Buffalo, N. Y., announces that EDWARD F. MORGAN and JAMES A. CARTER, formerly with Henry Prentiss & Co., are now connected with the Keller company. Mr. Morgan will be located at Buffalo, and Mr. Carter at Rochester.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that W. R. KING has been placed in charge of all activities in connection with the promotion and sale of motors, controls, and other electrical apparatus to the machine tool industry. Mr. King has been associated with the company since 1928, when he joined the organization as a student engineer.



W. R. King, of General Electric Co., Now in Charge of Promotion and Sale of Electric Apparatus to Machine Tool Industry

W. C. JONES MACHINE PRODUCTS CO., 318-324 Pearl St., Syracuse, N. Y., is the new name adopted by the former STOWELL & JONES MACHINE CO., of the same address. No change has been made in the management of the company. W. C. JONES remains president.

HOWARD M. DAWSON, formerly of the Detroit office of the Jessop Steel Co., Washington, Pa., is now in charge of the company's export department, with headquarters at the New York district office, 2 Rector St.

Howard M. Dawson, Head of Export Department of Jessop Steel Co.

ROBERT BURDETTE DALE, formerly head of the Department of Industrial Management and Mechanical Engineering at Pratt Institute, Brooklyn, N. Y., is now associated with Morris & Van Wormer, industrial engineers, 25 Broad St., New York City. Mr. Dale's engineering experience covers a wide field. Concurrently with his work as an engineering educator, he has been engaged in consulting engineering in New York since 1925.

ELMER W. SILVER, secretary of the Whitehead Metal Products Co., Inc., New York City, has been elected treasurer, succeeding WILLIAM L. RIANHARD, who died recently. Mr. Silver will also continue as secretary. He has been with the company for over twenty-six years.

CHARLES MILLER, who has been with the Ralph C. Coxhead Corporation, manufacturer of the Vari-Typer, 333 Sixth Ave., New York City, since 1936, has been appointed factory superintendent.

LINLEY BROTHERS CO., Bridgeport, Conn., has appointed VICTOR BROOK, Rochester, N. Y., exclusive representative for the Linley vertical milling machine and jig borer in New York State north and west of Putnam and Orange Counties.

CLUTSOM MACHINES INCORPORATED, 205 E. 42nd St., New York City, has been appointed exclusive agent in Massachusetts and Rhode Island for the DEARBORN GAGE CO., Dearborn, Mich.

RALPH C. STUART has been appointed manager of manufacturing to supervise production at five plants of the Lamp Division of the Westinghouse Electric & Mfg. Co., at Bloomfield, N. J. Mr. Stuart was formerly manager of parts manufacturing at the Lamp Division.

## Ohio

INDUSTRIAL OVEN ENGINEERING DIVISION OF THE METAL EQUIPMENT CO. announces that, owing to the large amount of special contract engineering work, together with automatic equipment design, that the division has been handling, a separate organization has been set up to take over this work, known as the INDUSTRIAL OVEN ENGINEERING CO. The new organization consists basically of the old one plus a contract engineering department, which specializes in material handling and special process engineering. The chief engineer of the new organization is C. A. LITZLER. The offices are in the Granada Building at 11621 Detroit Ave., Cleveland, Ohio.

W. N. WOOD has been appointed plant manager of the American Propeller Corporation, Toledo, Ohio, succeeding WAYNE EDDY, who has resigned. Mr. Wood was previously factory manager of the Propeller Division of the Curtiss-Wright Corporation at Caldwell, N. J.

## Pennsylvania

WILLIAM S. SHIPLEY, chairman of the board of the York Ice Machinery Corporation, York, Pa., has been appointed director and vice-chairman of the War Production Board's Small War Plants Corporation. RALPH B. MEISENHELDER, assistant to the president, has been appointed the company's director of War Contract progress. JOHN CARR has been appointed export sales manager of the corporation.

G. P. LONGABAUGH has been made section manufacturing engineer on the sub-contracting staff of the Westinghouse Electric & Mfg. Co., East

# Home to Roost

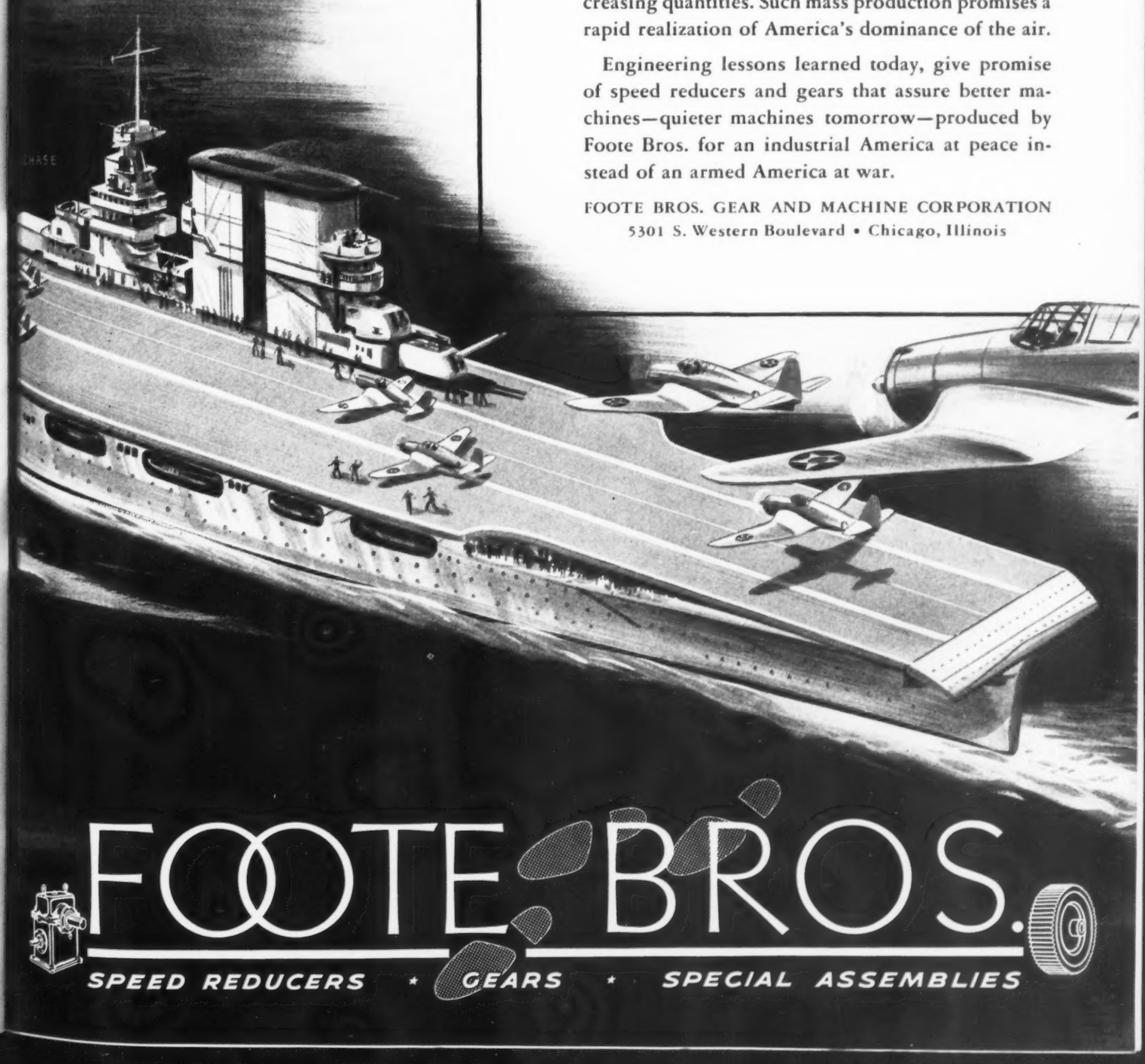
HOME TO ROOST, these eagles of the fleet return from their exploits of daring. In a voice a billion horsepower strong, the story they tell of American industrial might is ringing in the ears of Axis powers from Honshu to Hamburg.

That such an intricate mechanism as the engines that power these war eagles can be mass-produced is a tribute to the mechanical genius of American industry.

To transmit the thousands of horsepower that modern aircraft engines develop, gears must be finished to an accuracy that only a few months ago was considered a laboratory ideal. Yet today, thanks to new manufacturing techniques, these gears are rolling off production lines at Foote Bros. plant in ever increasing quantities. Such mass production promises a rapid realization of America's dominance of the air.

Engineering lessons learned today, give promise of speed reducers and gears that assure better machines—quieter machines tomorrow—produced by Foote Bros. for an industrial America at peace instead of an armed America at war.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois



FOOTE BROS.

SPEED REDUCERS ★ GEARS ★ SPECIAL ASSEMBLIES

Pittsburgh, Pa. His duties will consist of coordinating and directing the manufacturing engineering activities of the sub-contracting program. He previously served as manufacturing engineer on the headquarters' manufacturing staff.

WILLIAM A. HARDING has been appointed manager of the sheet, plate, and specialties department of the Jessop Steel Co., Washington, Pa.

William A. Harding, Manager of Sheet, Plate and Specialty Department of the Jessop Steel Co.

Mr. Harding studied metallurgy at the Polytechnic Institute of Brooklyn, N. Y., and was associated for twenty years with the Crucible Steel Co.

WESTINGHOUSE ELECTRIC & MFG. CO. announces that five of the company's Pennsylvania and New Jersey plants have received the new Army-Navy Award pennant for "high achievement in the production of war equipment."

YORK ICE MACHINERY CO., York, Pa., announces that its Pittsburgh branch has been moved to the Hostetter Bldg., 7 Ferry St., Pittsburgh, Pa.

WYCKOFF DRAWN STEEL CO., Pittsburgh, Pa., has been awarded the Army-Navy "E" pennant for its outstanding performance in the production of war materials.

## Washington, D. C.

R. S. NEBLETT, assistant manager of the General Electric Co.'s turbine division, has received an appointment to work with the Bureau of Ships of the U. S. Navy. He will be connected with the Bureau's office at Washington, D. C.

## Wisconsin and Minnesota

GISHOLT MACHINE CO., Madison, Wis., has appointed the following district sales representatives and agents: For the Ohio territory, RAY HERING, 1817 N.B.C. Bldg., Cleveland; Michigan territory, EARL K. BAXTER, 5-168 General Motors Bldg., Detroit; Texas territory, B. C. GREENE and STEEL & MACHINE TOOL SALES, INC., 6416 Navigation Blvd., Houston; Washington territory, DAWSON MACHINERY CO., 1736 First Ave. S., Seattle; Nova Scotia, New Brunswick and Newfoundland territories, FOULIS ENGINEERING SALES CO., 321 Capitol Bldg., Halifax, Nova Scotia, Canada.

TIGHT CLOSURE CO., 3056 W. Meinecke Ave., Milwaukee, Wis., has recently been organized to do custom molding of thermo-setting plastic products. The company's facilities include a number of compression molding presses ranging from 65 to 300 tons at temperatures up to 350 degrees F. It will also provide plastic molds.

LOHED HOIST DIVISION OF THE AMERICAN ENGINEERING CO., Philadelphia, Pa., has appointed the EILER EQUIPMENT CO., 617 N. Washington Ave., Minneapolis, Minn., representative for Lo-Hed electric hoists.

# COMING EVENTS

SEPTEMBER 22-24 — Annual meeting of the ASSOCIATION OF IRON AND STEEL ENGINEERS at the Hotel William Penn, Pittsburgh, Pa.

SEPTEMBER 29-30 — AMERICAN MANAGEMENT ASSOCIATION CONFERENCE ON MANPOWER AND WAR LABOR PROBLEMS at the Hotel Pennsylvania, New York City. Further information can be obtained from the American Management Association, 330 W. 42nd St., New York City.

OCTOBER 1-3 — NATIONAL AIRCRAFT PRODUCTION MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Biltmore, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 12-14 — National fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Sagamore, Rochester, N. Y. C. E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 12-16 — NATIONAL METAL CONGRESS AND EXPOSITION in Cleveland, sponsored by the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland.

OCTOBER 12-16 — Annual meeting of the AMERICAN WELDING SOCIETY at the Hotel Cleveland in Cleveland, Ohio; headquarters of the Society, 33 W. 39th St., New York City.

OCTOBER 16-17 — Tenth semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS, to be known as the War Production Conference of the Society, at Springfield, Mass., with headquarters at the Hotel Kimball. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

OCTOBER 27-29—Thirty-first NATIONAL SAFETY CONGRESS AND EXPOSITION in Chicago, with headquarters at the Sherman Hotel. For further information, address National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

NOVEMBER 24-29 — NATIONAL CHEMICAL EXPOSITION AND INDUSTRIAL CHEMICAL CONFERENCE at the Sherman Hotel, Chicago, Ill. For further information, address National Chemical Exposition, 110 N. Franklin St., Chicago, Ill.

NOVEMBER 30-DECEMBER 3 — Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Astor, New York City. Secretary, C. E. Davies, 29 W. 39th St., New York City.

NOVEMBER 30-DECEMBER 5—Fifteenth NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

JANUARY 11-15, 1943—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

* * *

## Machine Tool Electrical Standards

The American Standards Association has announced the completion of another American standard — Machine Tool Electrical Standards. This work was initiated by the National Machine Tool Builders' Association. The purpose of the standardization is to speed the manufacture of machine tools by standardizing the electrical wiring required. The standard has already been made mandatory by War Production Board Order L-147. Copies of the "Machine Tool Electrical Standards" can be obtained from the American Standards Association, 29 W. 39th St., New York City, at 40 cents a copy.

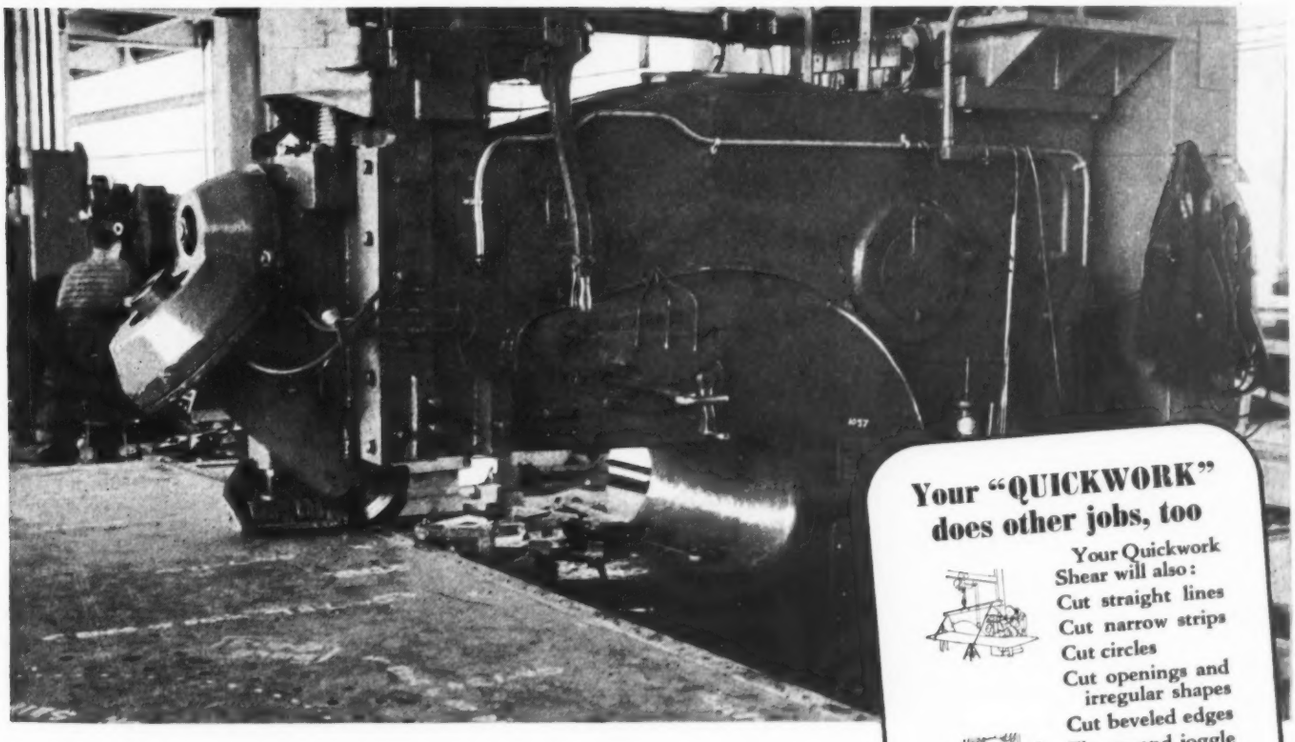
# Don't Wait for a New Machine use your QUICKWORK for JOGGLING

If you own a Quickwork Rotary Shear, whatever its original purpose, you can quickly put it to work joggling any type of sheet within the range of its capacity. For general work or straight production, your Quickwork-Whiting Shear with joggling attachment joggles straight or irregular shapes, inside or outside curves at high speeds. Uniformity of the joggled lap throughout the entire length of the work is assured.

Save delay—investigate the special attachments that make your Quickwork-Whiting Rotary Shear the most versatile tool in any shop.

*Above: Close-up of joggling operation showing joggled plate emerging from the rolls. Joggling rolls are adjustable for different metal thicknesses and are quickly interchangeable with standard cutters. Joggling operation can be done either before or after the beveling operation.*

Write for your copy of the new Quickwork-Whiting Special Auxiliary Attachments Bulletin.



## Your "QUICKWORK" does other jobs, too



Your Quickwork Shear will also:

Cut straight lines
Cut narrow strips
Cut circles
Cut openings and irregular shapes
Cut beveled edges
Flange and joggle
Make clean cuts without burrs—in a single pass at high speeds.

Don't wait for a new machine. Use your Quickwork.

"QUICKWORK"

# WHITING

*Division of* Whiting Corporation, 15673 Lathrop Ave., Harvey, Illinois

# OBITUARIES

## John G. Benedict

John G. Benedict, president of the Landis Machine Co., Waynesboro, Pa., died in the Waynesboro Hospital on August 4 after an illness of two years. Mr. Benedict was born near Ringgold, Md., in 1872. While still a young man, he moved with his family to the vicinity of Waynesboro, where he later spent most of his life. He graduated in 1898 from the State Teachers College, Shippensburg, Pa., and taught school both during his college years and for two years following graduation.

In 1900, Mr. Benedict became an employe in the office of the Landis

Underwood & Underwood

John G. Benedict

Tool Co. Later, he became associated with the Fred Frick Clock Co., of Waynesboro, as secretary. He was then appointed branch manager in Minneapolis, Minn., for the Geiser Mfg. Co., also of Waynesboro. In 1904, he returned to Waynesboro to become secretary and treasurer of the Landis Machine Co., with which company he had been connected ever since, for many years as general manager and during recent years as president. Through his guidance and resourcefulness, this company has become one of the most important manufacturers of thread-cutting equipment in the world.

Mr. Benedict was also president of the Canadian Landis Machine Co., Welland, Ontario; president of the First National Bank & Trust Co. of Waynesboro; and a former vice-president of the Frick Co. of the same city. For two years he served as president of the National Metal Trades Association. He was a leader in civic affairs of Waynesboro; and many of its institutions, such as the Waynesboro Hospital, of which he was vice-president, and the Waynesboro Beneficial Fund Association, are greatly indebted to him.

Mr. Benedict is survived by his wife and two children, Dr. Helen Benedict and J. Downey Benedict, who is now a sergeant in the Sixth Armored Division of the U. S. Army, and one grandson.

Because of Mr. Benedict's sterling character and friendly personality, he was held in the highest esteem by all who came in contact with him. His many friends in the machinery industries will deeply regret to learn of his passing.

## Henry G. Reist

Henry G. Reist, retired head of the motor and generating engineering department of the General Electric Co., Schenectady, N. Y., died on July 5 in Schenectady after a short illness at the age of eighty years.

Mr. Reist was born in Mount Joy, Pa., in 1862, and graduated from Lehigh University with the degree of mechanical engineer in 1886. In 1889, he joined the Thomson-Houston Electric Co., Lynn, Mass., which, in 1892, was combined with the Edison General Electric Co. to form the present General Electric Co. In 1894, he took charge of designs for alternating-current machinery. He retired in 1931. Mr. Reist was granted many patents for his inventions, notable among which was the development of fabricated structures to replace castings in electrical apparatus. In 1929, Mr. Reist was a delegate to the World Engineering Congress and World Power Conference. For fifty-three years he was a member of the American Society of Mechanical Engineers, from which Society he received the Fifty-year Membership Medal.

## Perrin G. March

Perrin G. March, president of the Cincinnati Shaper Co., Cincinnati, Ohio, died at his home on July 18 of a heart attack. He was apparently in good health the previous day, being in his office as usual. Shortly after midnight, he suffered a heart attack. He was fifty-five years old.

Mr. March was born in Fernbank, Ohio, the son of Perrin G. March, Sr., who founded the Cincinnati Shaper Co. He was educated in the Cincinnati public school, and attended the University of Cincinnati and the Ohio State University. Afterward he entered the business founded by his father, of which he became the head. Mr. March was a member of the board

Blank & Stoller

Perrin G. March

of directors of the Ohio Mechanics Institute. He was also a member of the National Machine Tool Builders' Association and the Cincinnati branch of the National Metal Trades Association, of which organization he was at one time treasurer.

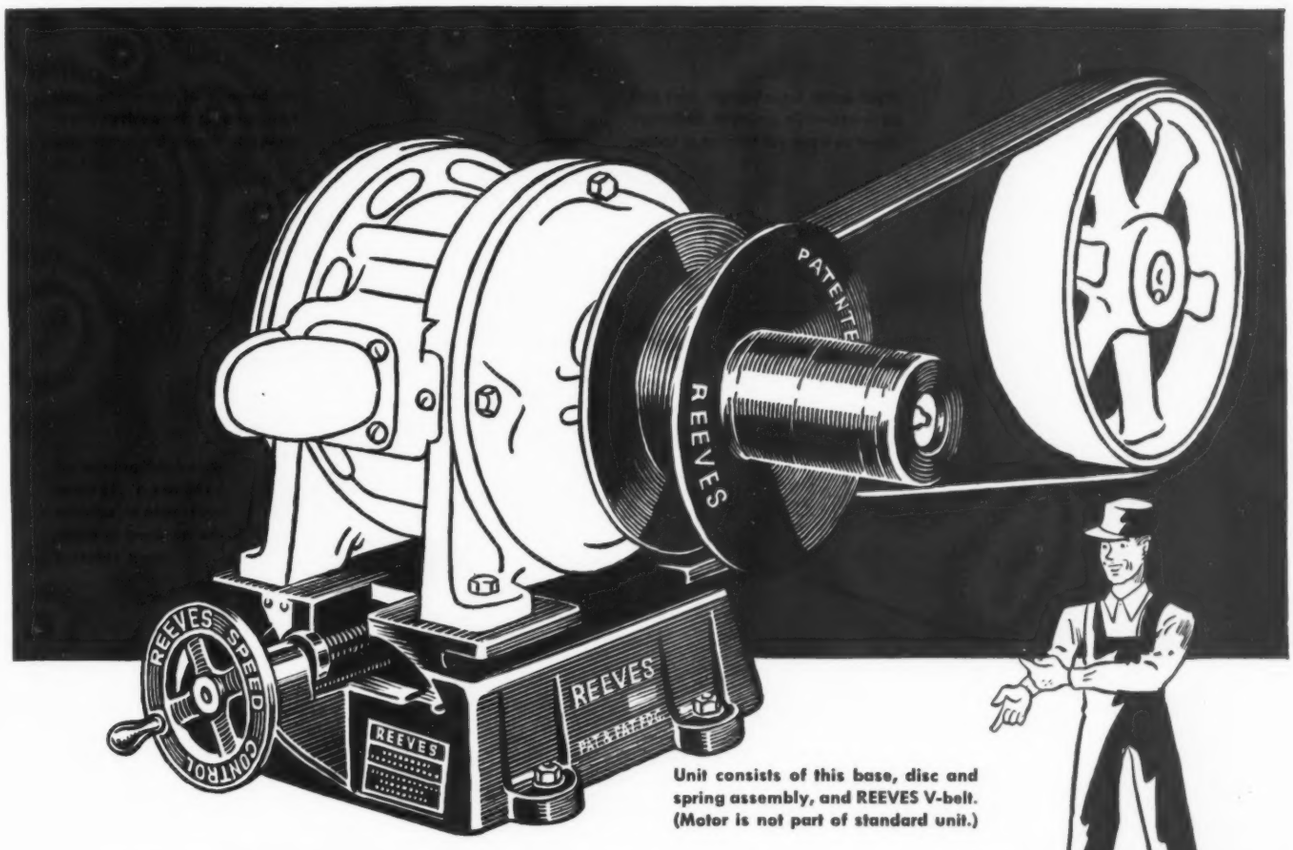
Mr. March is survived by his widow, Mary Jane March, and three sons.

## John F. Wyzalek

John F. Wyzalek, chief metallurgist of the Hyatt Bearings Division of the General Motors Corporation, and a nationally known authority on the heat-treatment of metals and carburizing methods, died suddenly on August 8 after a heart attack, aged forty-seven years. Mr. Wyzalek became connected with the Hyatt organization in 1913 as a laboratory technician, and remained with the firm's metallurgical department, becoming its head in 1928. He contributed many articles to the technical press on gas carburizing, heat-treating, and other metallurgical subjects. He was an active member of the American Iron and Steel Institute, the Army Ordnance Association, the American Society for Testing Materials, and the American Society for Metals. He served as a representative of the roller bearing manufacturers on the Technical Advisory Committee for Carbon and Alloy Steels of the Anti-Friction Bearing Manufacturers Association.

## William L. Rianhard

William L. Rianhard, treasurer of the Whitehead Metal Products Co., Inc., New York City, died suddenly on Friday, July 24, while traveling on a New Haven Railroad train to his summer home in New Preston, Conn. He would have been eighty-two years old on August 15.

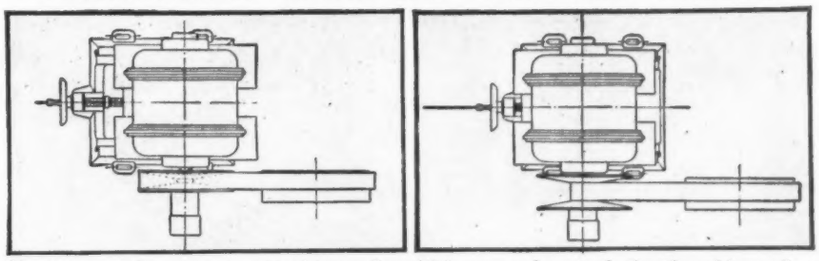



Unit consists of this base, disc and spring assembly, and REEVES V-belt. (Motor is not part of standard unit.)

# REEVES VARI-SPEED MOTOR PULLEY

Two cone-faced discs are mounted on the standard motor shaft extension. Motor is mounted on adjustable base. Through handwheel control, motor is moved forward or back, varying depth of throat between discs. A REEVES V-belt, running between discs and connected to driven machinery, is kept under constant tension by a compression spring. As depth of throat is varied, V-belt assumes different diameters of contact against discs. Speed adjustments are infinite between the limits, and are made while equipment is running. Constant torque; variable horsepower.

## REEVES OPERATING PRINCIPLE THAT GIVES PRODUCTION MACHINES "FIGHTING SPEEDS"



Maximum speed—motor nearest to driven pulley  Minimum speed—motor farthest from driven pulley

## THESE VITAL ADVANTAGES for War Production

**FULL-RANGE SPEED ADJUSTABILITY:** Not just steps in speed, but *any* speed—to meet changes in size, shape, periphery or type of work.

**NO WASTE IN TIME OR MATERIALS:** Speed can be adjusted to skill of workers, to prevent waste and spoilage. Speed changes made without stopping driven machine. Valuable aid to new workers.

**OPERATING PRINCIPLE PROVED** in 210,000 installations, including use as standard equipment on 1,440 different makes of machines.

**NATION-WIDE ENGINEERING SERVICE:** REEVES engineers in 36 leading industrial centers will help you choose the proper unit and apply it correctly.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

# REEVES Accurate Variable Speed Control

Mr. Rianhard, who was one of the oldest active executives in the metal industry, was born in New Brighton, Staten Island, N. Y. In 1881, he went to work as a clerk for Wallace & Sons, Ansonia, Conn.; later he went to Waterbury, and in 1898 became connected with the U. T. Hungerford Brass & Copper Co., serving until his retirement in 1916. However, he did not remain long in retirement. The metal industry had become so much part of his life that, in 1917, he joined the Whitehead Metal Products Co. as assistant treasurer and director. In 1924, he became treasurer of the Whitehead company, which since has become a subsidiary of the International Nickel Co.

JOHN L. BOSSERT, sales engineer for the Ward Leonard Electric Co., Mount Vernon, N. Y., for the last seventeen years, died at his home on July 9. Mr. Bossert was a graduate of Cooper Union, New York City, in electrical engineering.

WILLIAM PETERSON, who was associated with the Kelly Reamer Co., Cleveland, Ohio, for thirty years, and had been Detroit representative for that company since 1924, died in Detroit on July 24 at the age of fifty-five years. Mr. Peterson was well known in automotive production circles, and was a charter member of the Detroit chapter of the American Society of Tool Engineers.

# NEW BOOKS AND PUBLICATIONS

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. 1267 pages, 6 by 9 inches; 1784 illustrations. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, $1.50 in the United States; elsewhere, $2.

This edition of the Lincoln Procedure Handbook—the seventh—is greatly enlarged. The authors of the book have made every effort to provide as complete and up-to-date information as possible to help the men in the shops, shipyards, airplane factories, and ordnance plants to produce to the fullest extent. The book explains more fully than before the various methods and techniques used in welding. It is more completely and clearly illustrated; this applies particularly to the chapter on Typical Applications of Arc Welding. New information is given on welding symbols, allowable stresses, preheating, stress relieving, "Fleet-Fillet" technique, weldability of aluminum alloys, tubular construction, and many other subjects. This book has always been the result of cooperative effort, but more individuals and firms have contributed information and photographs to this edition than ever before. The publisher acknowledges the aid of nearly three hundred contributors.

The handbook covers the following eight sections: Welding methods and equipment; technique of welding; procedures, speeds, and costs; weld metal and methods of testing; weldability of metals; welded steel construction and machine design for welding; designing of arc-welded structures; typical applications of arc welding in manufacturing, construction, and maintenance.

SHOP MATHEMATICS AND SHOP THEORY. By John M. Amiss, G. Keith Shurtleff, and Hughitt G. Moltzau. 372 pages, 5 1/2 by 8 1/2 inches. Published by the Chrysler Corporation, Detroit, Mich. Price, $1.50.

This book presents short courses in shop mathematics and shop theory, based on the apprentice training course of the Chrysler Corporation. The content of these courses was determined after many experiments and revisions over a period of years, and was designed for apprentices who are high-school graduates having a background of algebra, geometry, physics, chemistry, mechanical drawing, and machine shop work. The first part of the book deals with shop mathematics and covers preliminary mathematical processes, logarithms, mensuration, geometry, trigonometry, application of shop mathematics, and blueprint problems. The second part of the book, dealing with shop theory, covers safety and fire protection; manufacturing methods; gages and measuring instruments; cutting tools; composition and heat-treatment of cutting tools; gearing; machine tools; handbook projects; special subjects, including superfinish, Oilite bearings, and plastics; and Chrysler engineering standards.

SHEET-METAL PATTERN DRAFTING. By Frank J. O'Rourke. 189 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $2.

As stated in the preface of this book, emphasis is placed on the fundamentals that should be understood by every sheet-metal worker. While much practical experience may be gained through actual work in the shop, it is necessary for the student who wishes to become a proficient sheet-metal draftsman and pattern-cutter to obtain a certain background of theoretical knowledge which it is the purpose of this book to provide. The object is to familiarize the reader with the basic principles that must be applied in laying out patterns on sheet metal. This is done by presenting a wide range of shop problems such as occur in everyday practice.

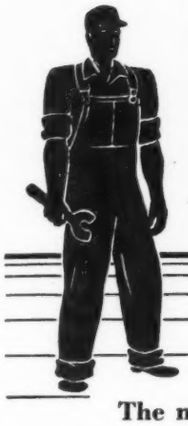
STRENGTH AND PROPERTIES OF MATERIALS. By John Elberfeld. 150 pages, 6 by 9 inches. Published by Harper & Brothers, 49 E. 33rd St., New York City. Price, $1.75.

This text-book is one of a series developed by the Rochester Athenaeum and Mechanics Institute, Rochester, N. Y., as part of its program for developing teaching material, practical in nature and closely related to the actual requirements of industry. The material presented, therefore, is based upon a thorough study of the immediate needs of industry and of the prerequisites of such courses as those in tool, machine, and structural design. The subject matter is so arranged that the terms and definitions used in connection with the strength and the properties of materials are presented first. Then follows information on the properties of materials and later specific items on design. One chapter briefly discusses the uses, properties, and manufacture of plastics. Two types of problems are provided at the end of each chapter, one to illustrate the principle involved, and the other to show practical applications.

GAGES AND THEIR USE IN INSPECTION. By Fred H. Colvin. 157 pages, 4 3/4 by 7 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $1.50.

This little book is an elementary treatment of the subject of gages, pointing out why gages are made and how they are constructed and used. Its aim is to make clear many of the terms and questions that cause confusion and misunderstanding. It contains eleven chapters treating of the following subjects: Gages and How They are Used; Measuring Instruments in Common Use; Types of Gages; Gage Tolerances and Gage Wear; Gage-Blocks and Dial Gages; Reed and Air Gages; Threads and Thread Gages; Special Types of Gages; Interchangeable Manufacture and Inspection; Salvaging and Selective Assembly; Kinds of Fit.

HOW TO READ ELECTRICAL BLUEPRINTS. By Gilbert M. Heine and Carl H. Dunlap. 378 pages, 5 1/2 by 8 1/2 inches. Published by the Ameri-

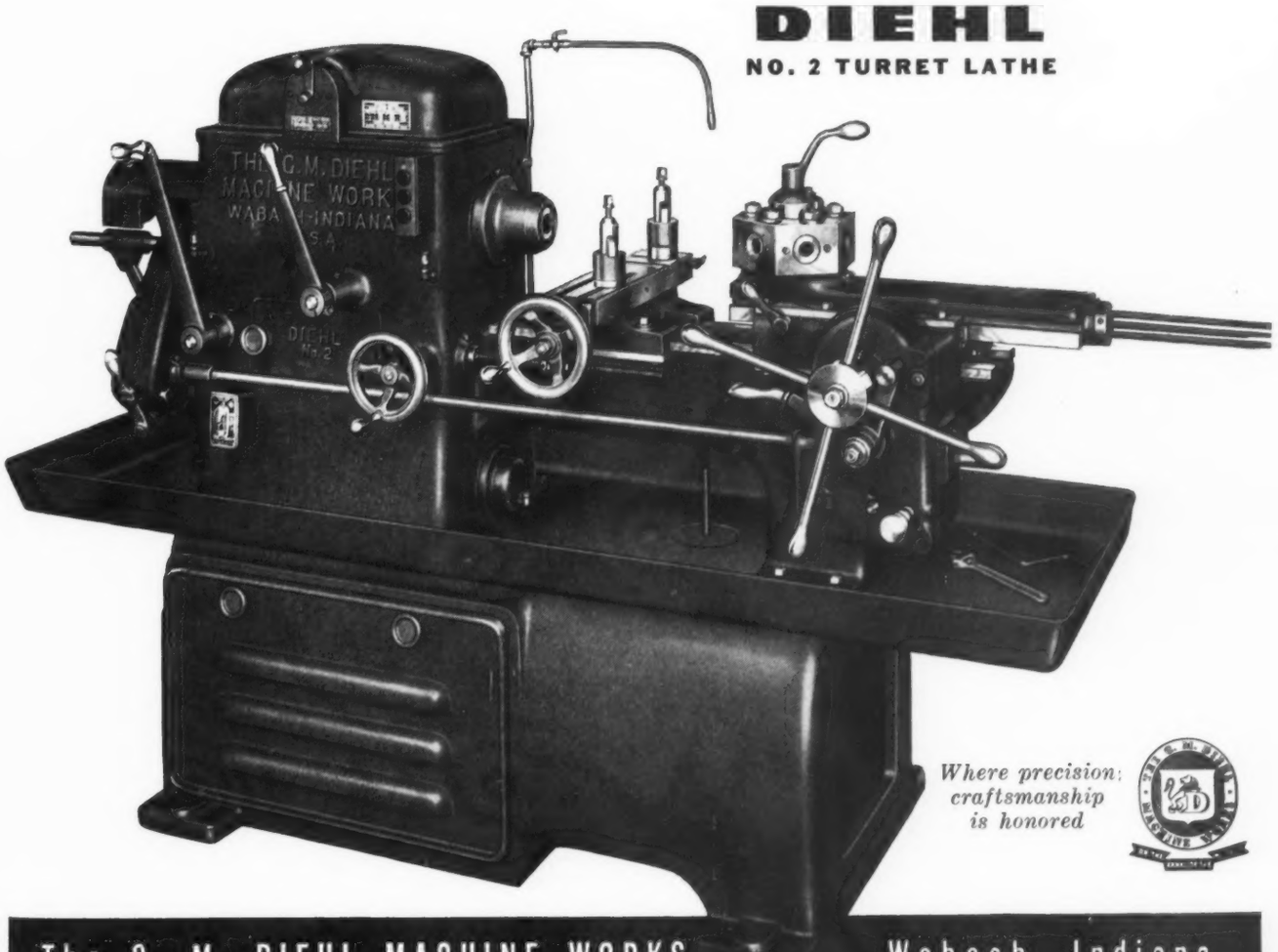


# ★ DIEHL ★

## POWERED for Wartime Production!

**The new Diehl Power Feed Model No. 2 Turret Lathe embodies characteristics that make it ideal for shops busy on war contracts. It is backed by a name that is outstanding in the field of heavy woodworking machinery, and is the result of years of designing and producing quality precision machinery. Because of today's pressing need for turret lathes in war industries, the Diehl name is appearing in the metal working field. We are sure that it will be sustained by the performance of our product. The Diehl Power Feed Model works alongside any other No. 2 Turret Lathe of standard make, using same tooling, including collets. Automatic chuck capacity (round)—1″; swing—over cross slide, 6″, over bed, 14″. Six speeds, forward and reverse. For complete details write for brochure.**

**DIEHL**
**NO. 2 TURRET LATHE**




*Where precision craftsmanship is honored*

**The G. M. DIEHL MACHINE WORKS** **Wabash, Indiana**

can Technical Society, 58th St. at Drexel Ave., Chicago, Ill. Price, $3.

The object and contents of this book can be best explained by listing the chapter headings as follows: Blueprints; How to Read Architectural Blueprints; How to Read Diagrams for Bell and Signal Wiring; How to Read House-Wiring Blueprints; How to Read Administration Building Blueprints; How to Read Automobile Wiring Diagrams; How to Read Diagrams of Generators and Motors; How to Read Symbols for Control Diagrams; How to Read Motor Control Diagrams; How to Read Power Station Blueprints.

TECHNIDATA HANDBOOK. By Edward Lupton Page. 64 pages, 5 1/2 by 8 1/2 inches. Published by the Norman W. Henley Publishing Co., 17-19 W. 45th St., New York City. Price, $1.

This handbook contains fundamental facts pertaining to mathematics, mechanics, physics, and chemistry, giving basic formulas and tables, most of which are reproduced from lettered or typewritten copy. The book contains such information as the author compiled for his own use as a student, and which he found useful to have around in small, compact form.

FLEXURAL-TORSIONAL BUCKLING OF BARS OF OPEN SECTION. By J. N. Goodier. 16 pages, 6 by 9 inches. Published by the College of Engineering, Cornell University, Ithaca, N. Y., as Bulletin No. 28 of the Engineering Experiment Station. Price, 30 cents.

This bulletin presents a mathematical analysis of a type of buckling encountered in tests of aircraft components.

LET'S WRITE GOOD LETTERS. By Sherman Perry. 176 pages, 5 1/2 by 8 3/4 inches. Published by the American Rolling Mill Co., 703 Curtiss St., Middletown, Ohio. Price, $1 plus 3 per cent sales tax in Ohio.

OPERATION OF COMMON WOODWORKING MACHINES. By Herman Hjorth. 163 pages, 8 by 10 inches. Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee, Wis. Price, $1.72.

RECOMMENDED PRACTICES FOR INSPECTION OF FUSION WELDING. (Tentative) 23 pages, 6 by 9 inches. Published by the American Welding Society, 33 W. 39th St., New York City. Price, 40 cents.

IRON PIONEER—HENRY W. OLIVER. By Henry Oliver Evans. 370 pages, 6 by 8 3/4 inches. Published by E. P. Dutton & Co., New York City. Price, $3.50.

## War Conditions Halt Westinghouse Wage and Salary Bonus

The Westinghouse Electric & Mfg. Co. has announced its intention of discontinuing the company's wage and salary payment plan, under which all employes share in the company's earnings over and above their regular monthly pay. This action has been necessitated by recently enacted laws providing for the renegotiation of contracts with the Government and subcontracts relating to them, and also by provisions for refunding of profits, which prevent the company from determining definite earning figures monthly, or even yearly. Increased taxes have also had their effect on the discontinuance of the plan. Federal normal and excess profits taxes for the first six months of 1942 are at the rate of over $52,350,000, compared with $17,635,000 for the same period in 1941.

* * *

## New Method of Using Steel Wool

A new method of using steel wool has been developed by the American Steel Wool Mfg. Co., Inc., 42-24 Orchard St., Long Island City, N. Y. By wrapping Type A ribbon steel wool, manufactured by this company, around a small shaft and then mounting the completed shaft or spindle in a chuck, it is possible to use this as a rotating finishing tool for removing burrs from non-ferrous metals. When so used, no permanent grooves are formed and there is no waste of steel wool. As the spindle wears down, it is only necessary to wrap an additional length of ribbon steel wool around that remaining on the spindle.

* * *

## Another Use for Induction Heating

In the manufacture of certain threaded ordnance material, it was found that the tap and chaser life was very short. Investigation showed the trouble to be caused by hardened shot from a previous shot-blasting operation lodging in the tap and chaser threads and interfering with the thread-cutting action. In order to obviate this condition, it was found necessary to heat the inside of the parts to an annealing temperature, without having the heat penetrate the body metal and change its physical characteristics. By the use of specially designed coils, this annealing was done on a Thermonic induction generator, built by the Induction Heating Corporation, 389 Lafayette St., New York City, at the rate of four pieces every fifty seconds.

## Automotive Industry Expedites Information Exchange

According to an announcement made by Robert F. Black, president of the White Motor Co. and a vice-president of the Automotive Council for War Production, a new service is being provided for members of the group of automotive manufacturers engaged in war production. This service, known as "Production Information," will be in the form of a report to members, covering production short-cuts and improved methods developed by individual companies; thus, when important progress is made, the data will be available to all members without delay. The reports will be issued and distributed immediately upon the discovery of a new technique that will speed or otherwise improve war production.

* * *

## Foremen Convention will Witness Novel Drilling Demonstration

At the Foremen's National Convention to be held at the Hotel Sherman, Chicago, Ill., September 25 and 26, the Black Drill Co., Cleveland, Ohio, will stage a demonstration of the new material "Hardsteel," now available for drills, reamers, and tool bits. Foremen from industrial plants are invited to bring with them samples of hardened steel or pieces of steel that they have found impossible or troublesome to drill with ordinary drills. Tools made from "Hardsteel" will drill materials having a Rockwell C hardness of 40 or higher.

* * *

## Aids to Close Inspection

Magnifying lenses, known as "Super Sight," for use in close inspection work, small parts assembly, and precision machining, have been placed on the market by the Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich. This equipment is made in several types, with one or two magnifying lenses and with magnifications of from four to five diameters. The lenses are held in adjustable brackets, so that they can be set in any convenient position.

* * *

The General Electric Co. is employing many women in its war production. Recently, the company hired 150 young college women to do work formerly done by men engineers. Twenty-two of the newly hired women are now at work, and are being given the company's regular engineering course in testing.

*and now ---*

# THERE IS NO GEAR TOO SMALL TO BE FINISHED BY "SHAVING"


A one inch diameter annular gear being finished on a new Michigan 861-4B.

The new Michigan 861-4B which will accurately finish machine the minutest gear in far less time than it takes to read this advertisement.

For the past few months we have been busy telling you about the new "Michigans" on which you can shave gears up to 4 ft. in diameter.

Now we would like to introduce to you the new Michigan 861, designed for the producer of small gears—for instruments, for control mechanisms, etc.—from a maximum of four inch diameter down to as close to zero diameter as you can make a gear.

It will handle gears up to 1 inch face width and down to "nothing". The gears can be mounted on shafts up to 9 inches long or they can be annular types with no shafts at all.

Just rough them out, put them on the Michigan 861-4B crossed axis gear finisher and in a few seconds they will be finished to within tenths of a thousandth.

**MICHIGAN TOOL**

7171 E. McNICHOLS ROAD *Company* DETROIT, U.S.A.

# Classified Contents of this Number